

PREPARED
BY



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Falls Road/Northern Parkway Corridor Study

October 2, 2020

This DRAFT report reflects the CONSULTANT'S TECHNICAL ANALYSIS and is intended for use by the public in making comments. As such, the City of Baltimore has not yet accepted or adopted the report's findings, conclusions, or recommendations.

Public comments are due no later than the close of business on Friday, November 20th to FallsandNorthernStudy@baltimorecity.gov.

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Introduction

A well-maintained and reliable transportation network that provides access to places of employment, shopping, health care, and entertainment is essential for all communities. But in 2020, residents and commuters in the Falls Road and Northern Parkway transportation corridors (**Figure 1**) daily feel the competing influences of through traffic between downtown Baltimore and points north with the ease, safety, and reliability of their local trips. Infrastructure deterioration such as faded guide signs, pavement failure, poor sidewalk and bus stop conditions are a detriment to the quality of life in the corridor.

Study Purpose

The Falls Road/Northern Parkway Transportation Corridor Study has as its purpose to identify solutions that can:

- Manage the road network to meet current and future travel demand
- Address traffic operations and safety concerns and improve conditions for people walking, biking, or using transit.
- Bring transportation infrastructure to a state of good repair

The core study area spans Falls Road from the Village at Cross Keys to the City/County Line near Lake Avenue and along Northern Parkway from Greenspring Avenue to Roland Avenue, but solutions developed for this core area will be informed by travel demand to and from origins and destinations just beyond its borders.

Project Need

A successful study and resulting project will address the following needs.

- **State of Good Repair:** Highway guide signs are faded and not compliant with current standards; lane markings are faded; asphalt and concrete surfaces are failing in certain areas.
- **Traffic Operations and Safety:** The intersection currently operates with excessive delays and queues that exceed the capacity of turn lanes and extend through adjacent signals, causing issues with weaving/lane changes and other safety concerns. Residual queues occur for multiple movements during both the AM and PM peak hours, and left turn movements in the southbound and eastbound directions exceed the capacity of the existing turn bays. The short intersection spacing between the Falls Road/Northern Parkway and I-83 ramp signals means that queues interfere with operations along upstream through routes and intersections.

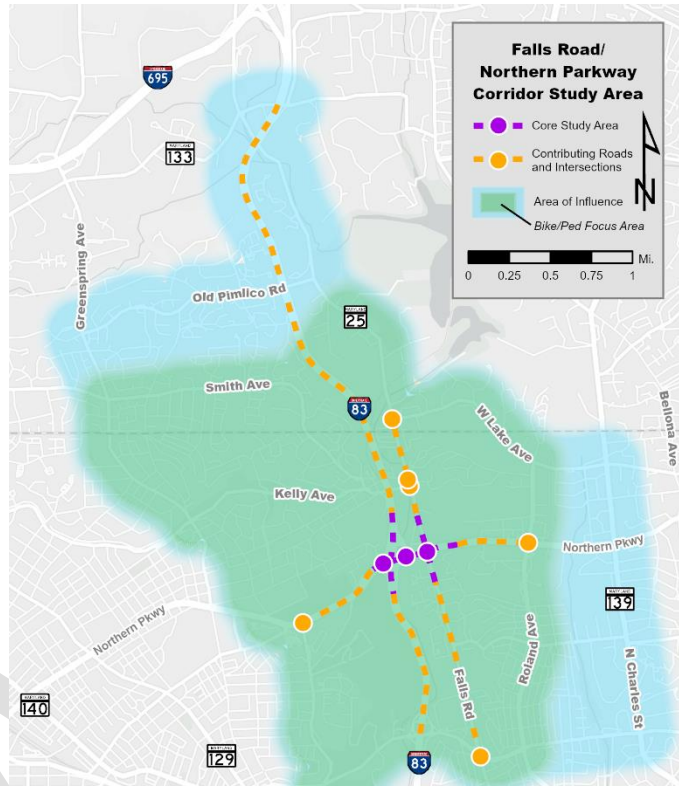


Figure 1. Falls Road and Northern Parkway Study Area Corridor

- **Bicycle, Pedestrian and Transit Access and Safety:** The current environment for bicyclists, pedestrians and transit riders in the study area is uncomfortable. Sidewalks are narrow and overgrown by vegetation, some sidewalks and curb ramps are not ADA compliant, bicycle facilities are not well designated and transit ridership in the area is low despite proximity to the light rail line in Mt. Washington.
- **Future Development and Traffic Capacity:** Study area roadways have not had any significant improvements over the last 50 years, and future development at Sinai Hospital, Pimlico Race Course, The Overlook, revitalization of Cross Keys and in the Jones Falls Valley, and along Falls Road in Baltimore County will add trips to and through the study area.

Prior Plans and Studies

There have been more than a dozen studies of traffic and transportation issues in the overall study area over the past fifteen years ranging from traffic signal optimization projects to bicycle and pedestrian studies to traffic impact studies of specific development projects. In addition, several small area or comprehensive plans have identified specific traffic and transportation issues. A full description of prior studies can be found in Appendix A.

Notable themes from these studies include:

- The need for improved bicycle and pedestrian connectivity to key destinations including light rail stops, parks, Sinai Hospital and other places of shopping and employment.
- A general desire for traffic calming improvements to reduce the impact of traffic that cuts through the affected neighborhood bound for a destination farther away.
- There is a need for development projects to mitigate traffic induced by the project.
- Consideration of additional access to I-83 in vicinity of Old Pimlico Road, and more recently improvements to the Falls and Old Court Roads to improve use of Ruxton Road exit ramp have been rejected by Baltimore County and nearby community associations dating to the mid-1980s.

Public Participation

At a public meeting in December 2019, community members communicated concerns about the study area to City staff. Among the concerns they identified were speeding on Falls Road, pedestrian safety and accessibility, transit access and reliability, and—especially within the context of anticipated future development at the Falls at Roland Park, Sinai Hospital, and Seton Business Park—traffic congestion in the core study area. This input informed the project’s purpose and need statement and laid the foundation for the four topics the study investigated: state of good repair, transit, pedestrian and bicycle transportation, and traffic congestion.

Following the City’s initial investigation into current traffic conditions and illustration of possible concepts that could address those observed and measured conditions, the City convened an intermediate virtual public meeting in May 2020 to present its preliminary traffic analysis and collection of possible concepts. Feedback at that meeting both validated the traffic analysis and supplemented it with valuable local knowledge.

Finally, in October 2020, the City presented the preferred alternative to community members and discussed likely next steps in a final virtual public meeting.

Part 1. The Study Area – Existing Conditions

North Central Baltimore is a largely residential area with pockets of commercial uses developed at the village scale; the communities sit along the edge of the Jones Falls which provided the power that fueled manufacturing in Baltimore in the 19th and 20th centuries. In the 1960s, the Jones Falls Expressway was built to ferry suburban commuters into downtown Baltimore, channelizing the Jones Falls in a concrete trough south of Mount Washington. While much of the environmental beauty of the Jones Falls Valley remains, the presence of major regional roadways is a constant competitor due to noise, speed, air quality and traffic congestion concerns that accompany them.

Land Use

Immediately adjacent to the Falls Road/Northern Parkway intersection are commercial land uses: gasoline stations on the northeast and southeast corners and a landscape nursery on the southwest corner. The northwest corner of the intersection is a vacant, City-owned parcel that serves as a buffer to the Sabina-Mattfeldt community.

East of the study area, a mix of single-family residences and private educational institutions in Roland Park and North Roland Park/Poplar Hill mean that residential and institutional land uses predominate, with the notable exception of the Falls at Roland Park 238-unit midrise apartment building.

Between Falls Road and the Jones Falls Expressway and north of Northern Parkway are commercial areas of Mount Washington and the small residential community of Sabina-Mattfeldt, separated by the Jones Falls. South of Northern Parkway, the mixed-use Village of Cross Keys includes almost 700 residential units, 90,000 SF of commercial space, and a 147-room hotel.

The segment of the study area west of the Jones Falls Expressway has a strong healthcare emphasis, with the Mount Washington Pediatric Hospital north of Northern Parkway and Sinai Hospital to its south. Two civic parks—Cylburn Arboretum and Northwest Park straddle Northern Parkway as well. Residential areas of Mount Washington just north of Northern Parkway, including the Springwell Senior Living community, are also adjacent to the study corridors.

Environmental Features

The study area sits within the Jones Falls Valley among the most bucolic areas of the City and has notable environmental features. The Jones Falls is contained in a concrete channel in the study area, and its floodplain lies in close proximity to the study area.

Floodplain: Although the Falls Road/Northern Parkway intersection is not within the 100- or 500-year floodplain, the segment of Falls Road approximately between the Kabab Stop (5719 Falls Road) and Washingtonville Drive, including the intersections of Falls Road with Kelly Avenue and Smith Avenue, is within the floodplain (**Figure 2**). In addition, the Smith Avenue, Kelly Avenue, and Northern Parkway bridges (and associated ramps) span the floodplain. USGS stream gauge data indicates that the river has exceeded flood stage twice in the last ten years, on September 7, 2011 and April 30, 2014.¹ A more recent heavy rainfall event that took place on May 27, 2018 did not reach flood stage at the stream gauge and had greater impacts south of Mount Washington.

Wetlands: Wetlands within the study area are primarily limited to locations where streams cross under the study area roadways; these are classified as riverine wetlands² (codes R2UBH and R5UBH). However, there is a small freshwater emergent wetland³ just north of Northern Parkway between Cylburn Avenue and Greenspring Avenue and a narrow freshwater forested/shrub wetland⁴ near Northern Parkway at Cylburn Avenue.

Forest: Much of the land immediately adjacent to the study area roadways is forested, especially along Northern Parkway west of the Jones Falls Expressway and Falls Road south of Northern Parkway, but none of this land falls within forest conservation easements.

Rare, Threatened, and Endangered Species: The U.S. Fish and Wildlife Service reports that the Northern Long-eared Bat (*Myotis septentrionalis*), a species classified as “threatened,” would be potentially affected by activities in the study area. In addition, up to 11 migratory birds may be present in the study area. This is typical of conditions in the Baltimore region.

The Road Network

Northern Parkway is the primary east-west route in the study area, while the JFX is the primary north-south route. Falls Road parallels the JFX and provides local access to Cross Keys, Sabina-Mattfeldt, Mt. Washington and points north and south of the study area. Feeding into the primary roads in the study are other local arterials such as Roland Avenue, Coldspring Lane, and Greenspring Avenue which mostly provide access to residences and community institutions.



Figure 2. Study Area Floodplain

¹ USGS gage is # 01589440; there is a non-archived stream gage at the confluence of Western Run and the Jones Falls as well (<https://water.weather.gov/ahps2/hydrograph.php?wfo=lsx&gage=ifsm2>)

² NWI classification codes R2UBH (Jones Falls) and R5UBH (other small stream crossings)

³ NWI classification code PEM1C

⁴ NWI classification code PFO1A

Northern Parkway

Northern Parkway is a principal arterial roadway with a six-lane, 90-foot typical section including a 15-to-30-foot-wide landscaped median. In the eastbound direction, posted speed limit is 35 MPH west of Saint Mary's Seminary and 30 MPH east of that point; in the westbound direction, posted speed limit is 30 MPH throughout the study area. Right-of-way along Northern Parkway is approximately 100 feet wide in the western and eastern portions of the core study area. Between Cylburn Avenue and Falls Road, right-of-way is much wider due to intersections with Greenhaven Drive and Rogers Ave, as well as the Jones Falls Expressway interchange.

Northern Parkway provides east-west mobility throughout the northern tier of Baltimore City, from MD 26/Liberty Heights Avenue in the west to US 1/Belair road in the east, intersecting seven principal arterials throughout its 10.7-mile span. The road provides access to employment locations in Downtown Baltimore and in suburban job centers, as well as shopping and recreational destinations such as Reisterstown Road Plaza, Pimlico Race Course, Belvedere Square, and Mount Pleasant Golf Course, and institutional destinations including the Jewish Community Center, Sinai Hospital, St. Mary's Seminary, and a cluster of private schools in Roland Park, as well as residential areas, small businesses, and schools.

As shown in **Figure 3**, the junction of Northern Parkway with Falls Road and the Jones Falls Expressway (I-83) lies at the center of the highest Annual Average Daily Traffic (AADT) segments of Northern Parkway, demonstrating the importance of the Falls Road/Northern Parkway intersection within the roadway network of northern Baltimore City. AADT along Northern Parkway increases from about 31,500 to over 53,000 from Liberty Heights Avenue to the Jones Falls Expressway, drops to just over 45,000 east of I-83, remaining relatively constant as far as Loch Raven Boulevard, and then lowers to about 24,500 east of Loch Raven Boulevard, 18,000 east of McClean Boulevard, and 14,500 east of Harford Road.⁵

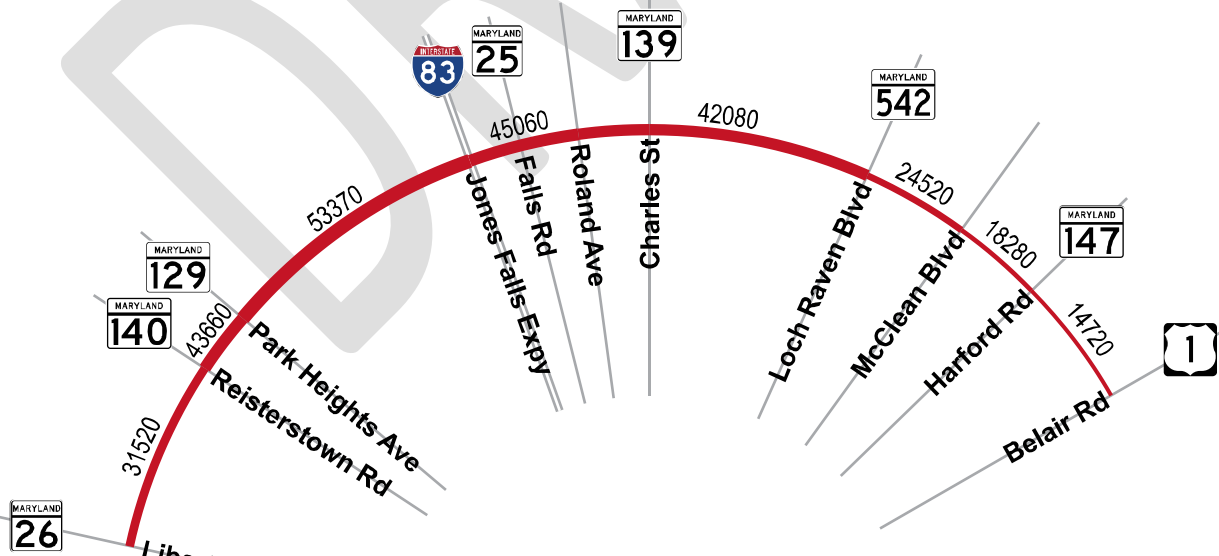
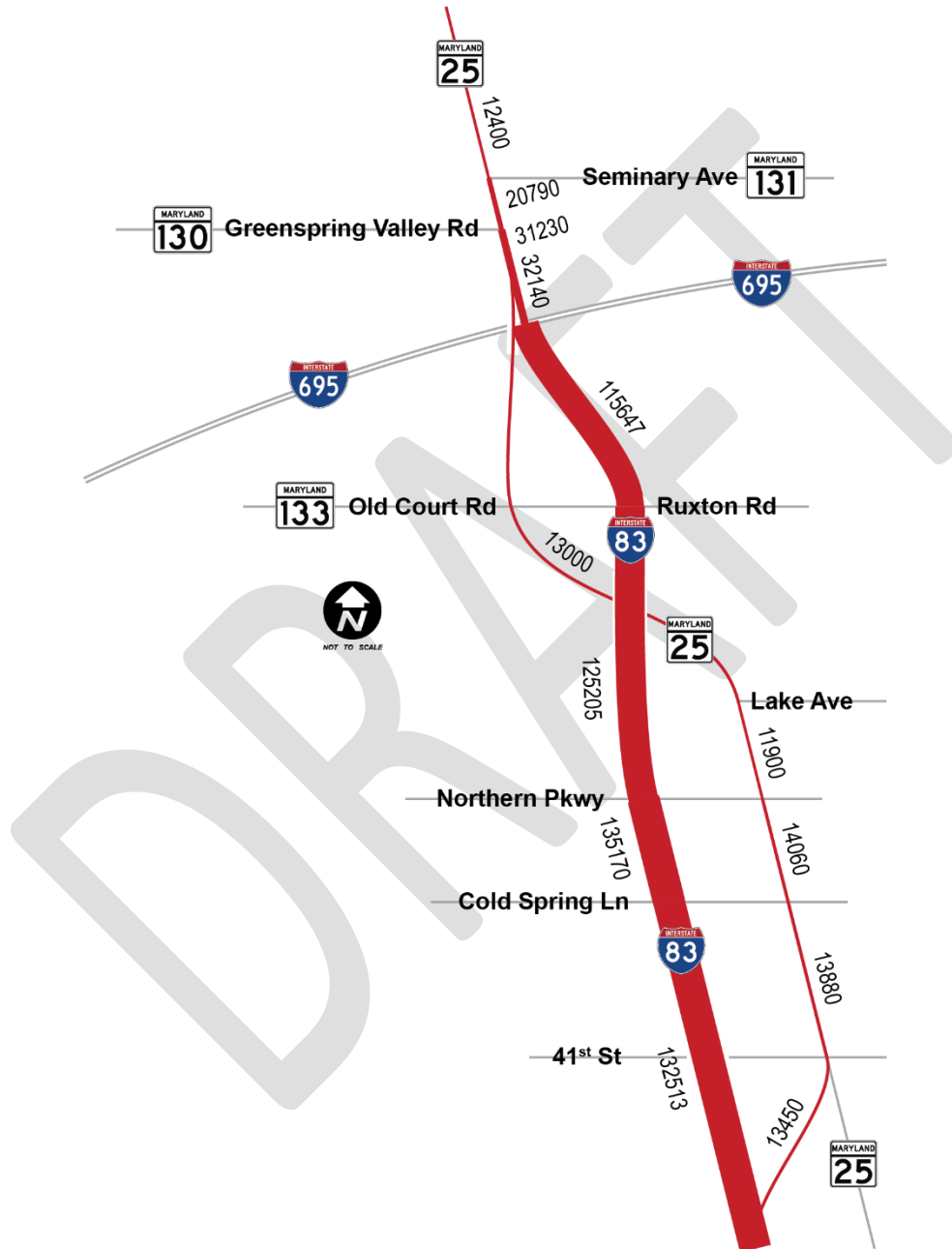


Figure 3. AADT (2017) Along Northern Parkway

⁵ Unless otherwise noted, the source for AADT is the MDOT SHA Traffic Station History, https://www.roads.maryland.gov/OPPEN/Station_history.pdf, with the exception of AADT figures for the two segments of the Jones Falls Expressway between Northern Parkway and I-695, for which the sources are 48-hour counts performed from May 9-10, 2017.

Jones Falls Expressway (JFX/I-83) and Bridge Crossings

The Jones Falls Expressway (JFX) provides north-south mobility within Baltimore City and inner suburbs of Baltimore County through the JFX I-695 interchange, providing broader access to suburban areas including Pikesville, Towson, and the Harrisburg Expressway (I-83) corridor north of I-695. As shown in **Figure 4** the JFX carries up to 135,000 AADT at its peak volume near Northern Parkway, and then drops to approximately 125,000 AADT north of Northern Parkway and 115,000 AADT between Ruxton Road



and I-695.

Figure 4. AADT (2017) Along Falls Road And The Jones Falls Expressway

Falls Road

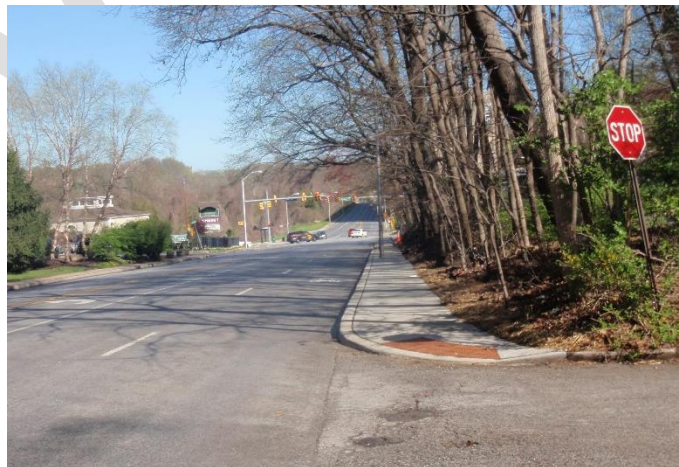
Falls Road is a minor arterial roadway with a two-lane, 36-foot typical section north of Smith Avenue and a four lane, 46-foot typical section south of Smith Avenue. Posted speed limit is 30 MPH south of the Falls at Northern Parkway north driveway and 25 MPH north of that point. Left-turn lanes are provided at Lake Avenue, Smith Avenue, Kelly Avenue, and Northern Parkway, and a channelized right-turn lane is provided from southbound Falls Road to westbound Northern Parkway. Right-of-way width along Falls Road is variable, ranging from approximately 43 to 120 feet. The roadway crosses gently rolling terrain, reaching several local low and high points through the study area.

Between the Exit 8 ramps from the JFX onto Falls Road in Hampden and Northern Parkway, AADT along Falls Road is relatively constant at approximately 13,500 to 14,000. North of Northern Parkway, AADT briefly drops to under 12,000 before rising again to approximately 13,000 at Lake Avenue.⁶

Pedestrian and Bicycle Infrastructure

Northern Parkway has sidewalks on both sides of the roadway from just west of the Light RailLink overpass to the east end of the study area at Roland Avenue. In the eastbound direction, sidewalks do not originate at a pedestrian generator but at the gore of the ramp from eastbound Northern Parkway to the southbound Jones Falls Expressway. In the westbound direction sidewalks end at the Northern Parkway and Rogers Avenue bus stop, and connect to sidewalks along Rogers Avenue, providing access to destinations such as Mount Washington Pediatric Hospital, Northwest Park, the Jones Falls Trail, and homes in the area. East of the study area, sidewalks provide continuous access to residences fronting on Northern Parkway and—less than a mile away—the commercial destinations along York Road.

Falls Road has continuous sidewalks throughout the study area north of Northern Parkway on the west side of Falls Road except for just south of Kelly Avenue where numerous businesses driveways result in continuous access breaks and sidewalk gaps. In the southbound direction, there is an approximately 225-foot gap directly south of Mount Washington Dry Cleaners, and in the northbound direction, there is an approximately 950-foot gap from the north driveway of the Falls at Roland Park to Joe's Bike Shop.



South of Northern Parkway, sidewalk is continuous on the west side of Falls Road but sporadic on the east side. A recently added segment connects the Northern Parkway intersection to the Falls Road Terrace northbound bus stop (**Figure 5**),

Figure 5. New Sidewalk Segment Between Falls Road Terrace And Northern Parkway

⁶ The source for 2017 AADT figures referenced in the Transportation Network Context section is the MDOT-SHA Traffic Station History, https://www.roads.maryland.gov/OPPEN/Station_history.pdf, with the exception of AADT figures for the two segments of the Jones Falls Expressway between Northern Parkway and I-695, for which the sources are 48-hour counts performed from May 9-10, 2017.

short segments provide a level waiting area at the Elmwood Road, Harvest Road, and Hamill Road bus stops, and continuous sidewalk to the south resumes at the Hillside Road bus stop.

There are signalized pedestrian crossings of Falls Road at Lake Avenue (south approach), Smith Avenue (north approach), Kelly Avenue (north and south approaches), Northern Parkway (north and south approaches), and the entrance to the Village at Cross Keys (south approach).

Along Northern Parkway, there are signalized pedestrian crossings at Roland Avenue (west and east approaches), the Gilman School and Bryn Mawr school driveways (west approach, as well as a pedestrian overpass), Roland Avenue (west and east approaches), and Falls Road (west and east approaches). All crossings of Northern Parkway except at Falls Road are marked as high-visibility crosswalks with diagonal markings or brick-stamped colored concrete (at Roland Avenue) between the longitudinal lines. Side-street crossings are marked with high-visibility crosswalks at all signalized intersections except for Northern Parkway, as well as all I-83 interchange ramps.

Bicycle infrastructure is limited throughout the study area. Along Falls Road, narrow shoulders accommodate bicycling south of Englewood Road, sharrows exist on some interior roadways in Roland Park. There is no existing designated bicycle infrastructure on Northern Parkway or Kelly Avenue. On the western edge of the study area, the Jones Falls Trail runs continuously from downtown Baltimore to Mt. Washington Village.

Figure 6 illustrates the routes of the existing facilities contained within the focus area.

Falls Road/Northern Parkway Corridors Study
Part 1. The Study Area – Existing Conditions



Figure 6. Existing Bicycle, Pedestrian, Rail and Transit Facilities

Traffic Operations and Safety

Traffic operations and safety were assessed both within the core study area and in the context of regional travel patterns.

Regional Traffic Distribution

Approximately 135,000 trips travel along I-83 daily with Northern Parkway being a significant breakpoint in traffic volumes as approximately 21,000 trips exit each day. Northern Parkway then distribute trips not only to City neighborhoods but also to many suburban communities adjacent to the Beltway between Pikesville and Parkville. A consideration in this study is whether or not there are adequate connections to and from I-83 to meet regional travel needs; that is, to what extent could traffic flowing *through* the intersection of Falls Road and Northern Parkway use other access points if they were available or had available capacity.

For example, there has been a long-held concern that traffic destined for Baltimore County communities just inside the Beltway (lower Pikesville and Ruxton/Riderwood, for example) uses the Northern Parkway exit and then travels north on Falls Road because those travelers would otherwise have to backtrack from the Ruxton Road exit of I-83 to reach their destination. Alternatively, operational improvements that ease congestion along I-695 between Pikesville and Parkville could reduce demand through the Falls Road intersection if motorists had less delay on I-695.

This study concludes that the large share of I-83 exits which travel out of the study area to the east and west are appropriate for Northern Parkway's classification as a principal arterial; however, with that 15% – 18% of traffic exiting at Northern Parkway could be diverted from the intersection at Falls Road if there were a mid-point exit as has previously been proposed in the vicinity of Old Pimlico Road, for example. Proposals for such an interstate access point have been rejected multiple times over the past 40 years by MDOT SHA and Baltimore County government, although there is evidence to indicate that such access may be warranted. **Figure 7** and **Table 1** indicate how traffic is distributed once exiting I-83 at Northern Parkway.⁷

⁷ The source for this table is Streetlight Data, a big-data source that uses anonymized smartphone location data to estimate the number of trips between origin-destination pairs on a typical weekday.

Falls Road/Northern Parkway Corridors Study Part 1. The Study Area – Existing Conditions

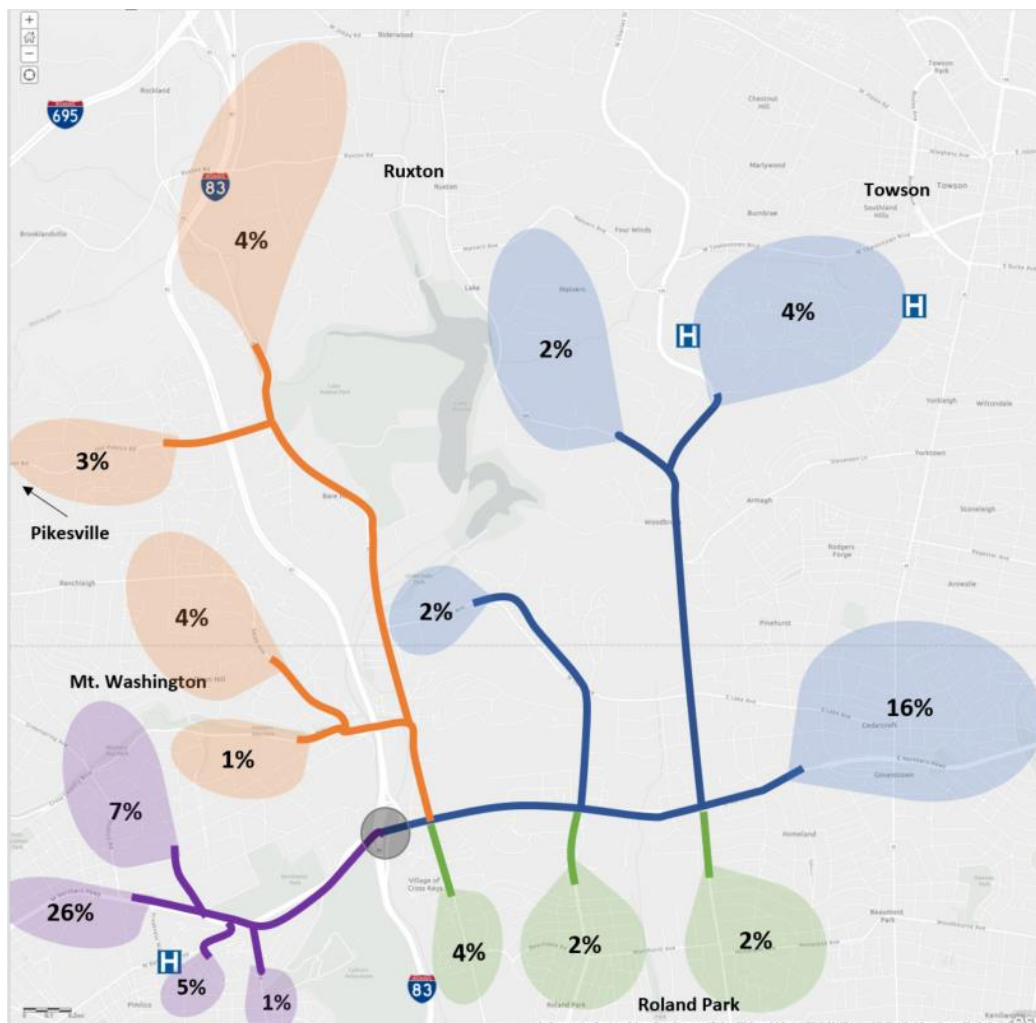


Figure 7. Traffic Distribution Exiting I-83 At Northern Parkway

Note: Each bubble indicates the percentage of traffic traveling in that direction from the northbound exit of the JFX. For example, approximately 4 percent of all exiting traffic turns south on Falls Road.

Falls Road/Northern Parkway Corridors Study
Part 1. The Study Area – Existing Conditions

Table 1. STUDY AREA DESTINATIONS FOR TRIPS

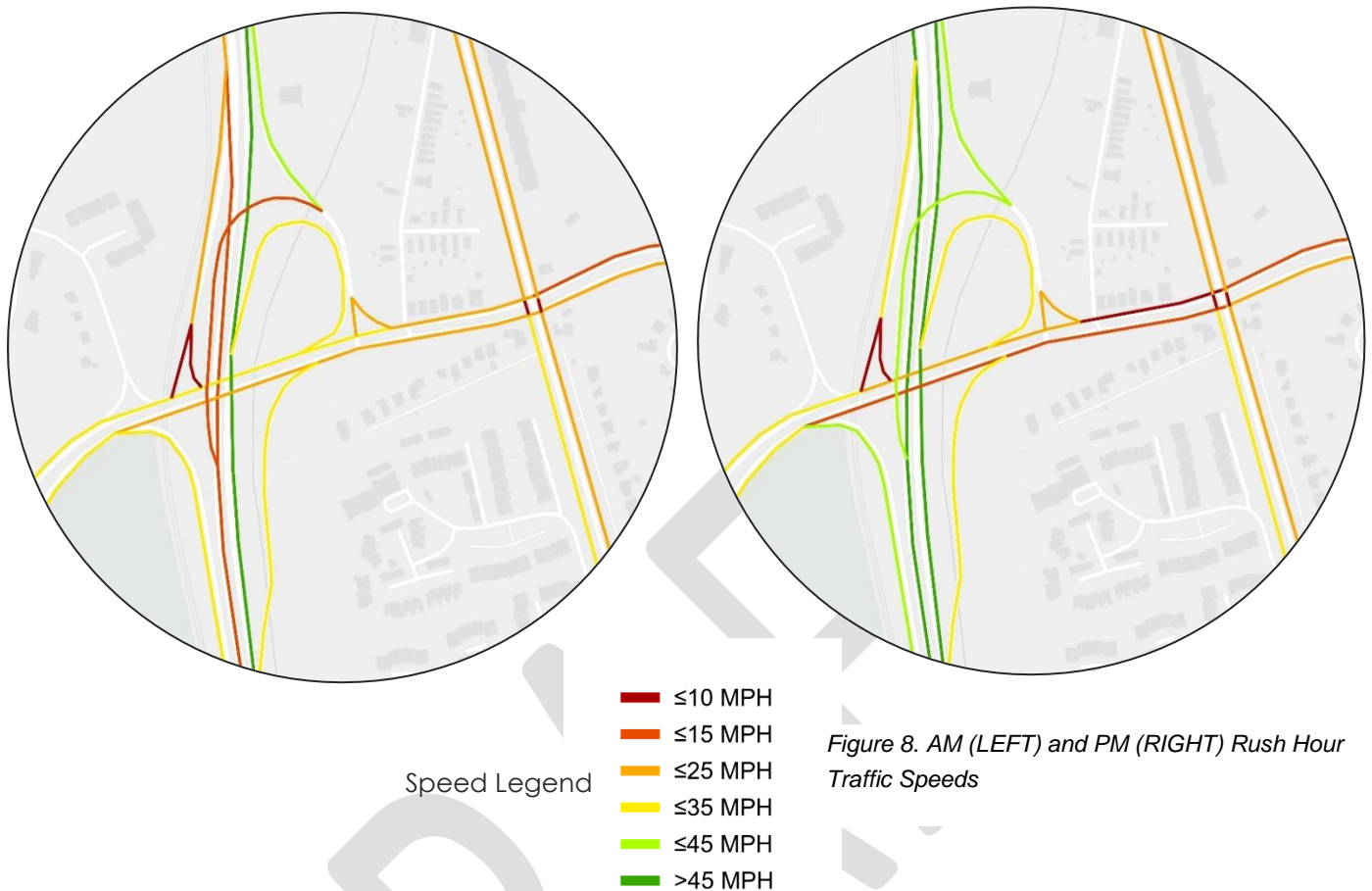
	NORTHBOUND		SOUTHBOUND	
ORIGIN: TRIPS EXITING AT NORTHERN PARKWAY	21,803	100%	11,894	100%
DESTINATION	Trips	Percent	Trips	Percent
Northern Pkwy (west of Greenspring)	5,515	26%	2,236	19%
Northern Pkwy (east of Charles)	3,389	16%	1,413	12%
Greenspring Ave	1,513	7%	206	2%
Falls Road (southbound)	791	4%	1,953	16%
Sinai Hospital	1,000	5%	1,455	12%
Falls Road (north of Old Pimlico)	948	4%	62	1%
Smith Ave.	850	4%	70	1%
Kelly Ave	136	1%	26	0%
Charles Street (north towards Towson)	756	4%	128	1%
Old Pimlico Road	639	3%	28	0%
Roland Avenue (south)	386	2%	1,130	9%
Charles Street (south)	418	2%	566	5%
Bellona Ave (west of Charles)	420	2%	26	0%
Lake Ave.	362	2%	75	1%
Cylburn Ave	303	1%	710	6%
Other locations	3,841	18%	1,898	16%

Note: approximately 17% of all trips exiting Northern Parkway travel to local streets directly within the study area.

Local Traffic Operations

Existing traffic operations are characterized by speed and level of service/delay. **Figure 8** below indicates the traffic speed in the morning and evening rush hour.

Falls Road/Northern Parkway Corridors Study
Part 1. The Study Area – Existing Conditions



By far the worst performing intersection within the study area is the intersection of Falls Road and Northern Parkway where overall intersection delays exceed the failing threshold during the AM peak hour and are near failing during the PM peak hour. This is primarily the result of significant westbound delays greater than 2 minutes during both peak hours.

The distance to the next signalized intersection in each direction (Roland Avenue to the east, Greenspring Avenue to the west, Kelly Avenue to the north, and Coldspring Lane to the south) provides enough spacing to not be affected by changes within the core study intersections and were removed from further consideration at the initial screening. As such further analysis of local traffic operations focused on the intersection of Falls Road and Northern Parkway and their interaction with the entrance/exit ramps to I-83.

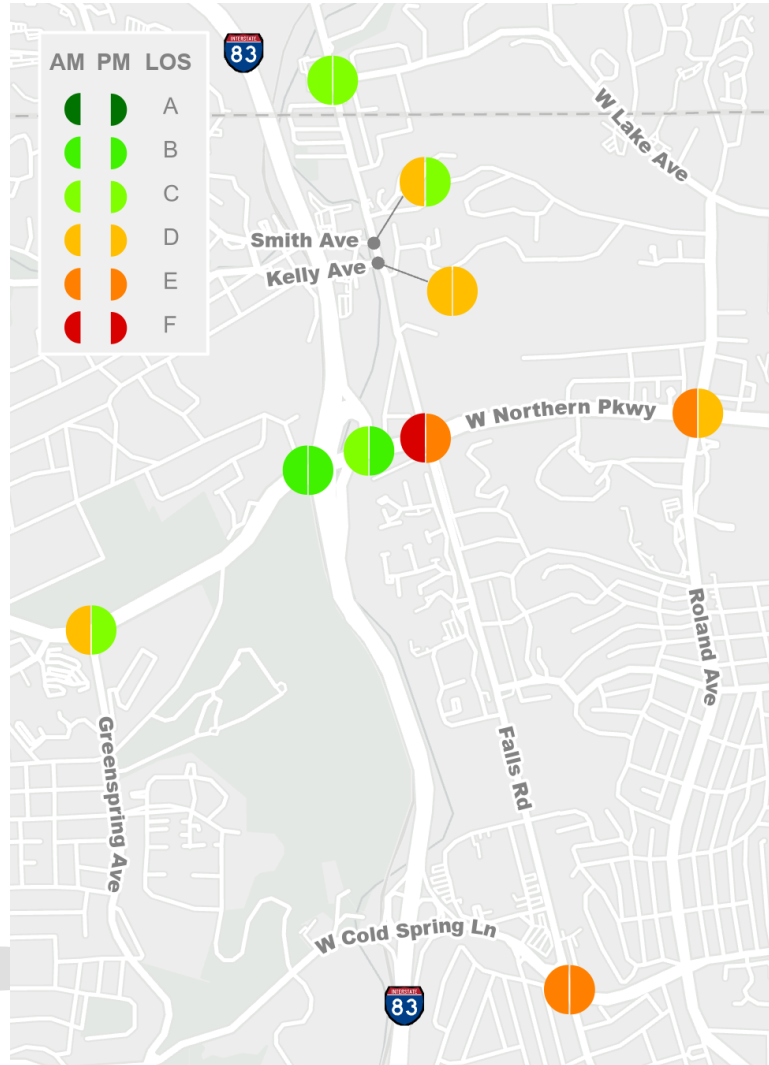


Figure 9. Existing Intersection Level of Service

An initial capacity analysis studied nine signalized intersections within the overall study area and found that six have at least one approach experiencing failing LOS F or v/c ratio > 1.00:⁸ (Table 2, Figure 9)

Roadway Safety

At the I-83 SB ramp, rear-end crashes constituted more than 50 percent of all collisions, and same-movement angle crashes constituted a further 20 percent (Figure 10). Like at the Falls Road/Northern Parkway intersection and the I-83 NB ramp, most collisions took place during dry conditions and caused property damage only. However, a greater percentage of collisions took place at night at the I-83 SB ramp (35 percent) than at the Falls Road/Northern Parkway intersection (25 percent) or the I-83 NB ramp (19 percent). Along Northern Parkway west of I-83, crash patterns were consistent with a high-speed

⁸ Key metrics for each include level of service (LOS), volume-to-capacity ratio (V/C), and delay; additional analysis to identify the root causes of operational problems was also performed using VISSIM. More detailed information on the traffic modeling process can be found in Appendix C.

roadway on a steep grade, with single-vehicle crashes (more than 40 percent), wet-roadway crashes (more than 50 percent), and daylight crashes (more than 60 percent) predominating. A greater share of Injury and Possible-Injury crashes (18 percent) took place there than at the Falls/Northern intersection (12 percent), the I-83 NB ramp (13 percent), and the I-83 SB ramp (16 percent). These characteristics differ from crash patterns at the intersections along Northern Parkway, as expected for a non-intersection crash location (**Figure 10**). More detailed information about crashes in the study area is in **Appendix B**.

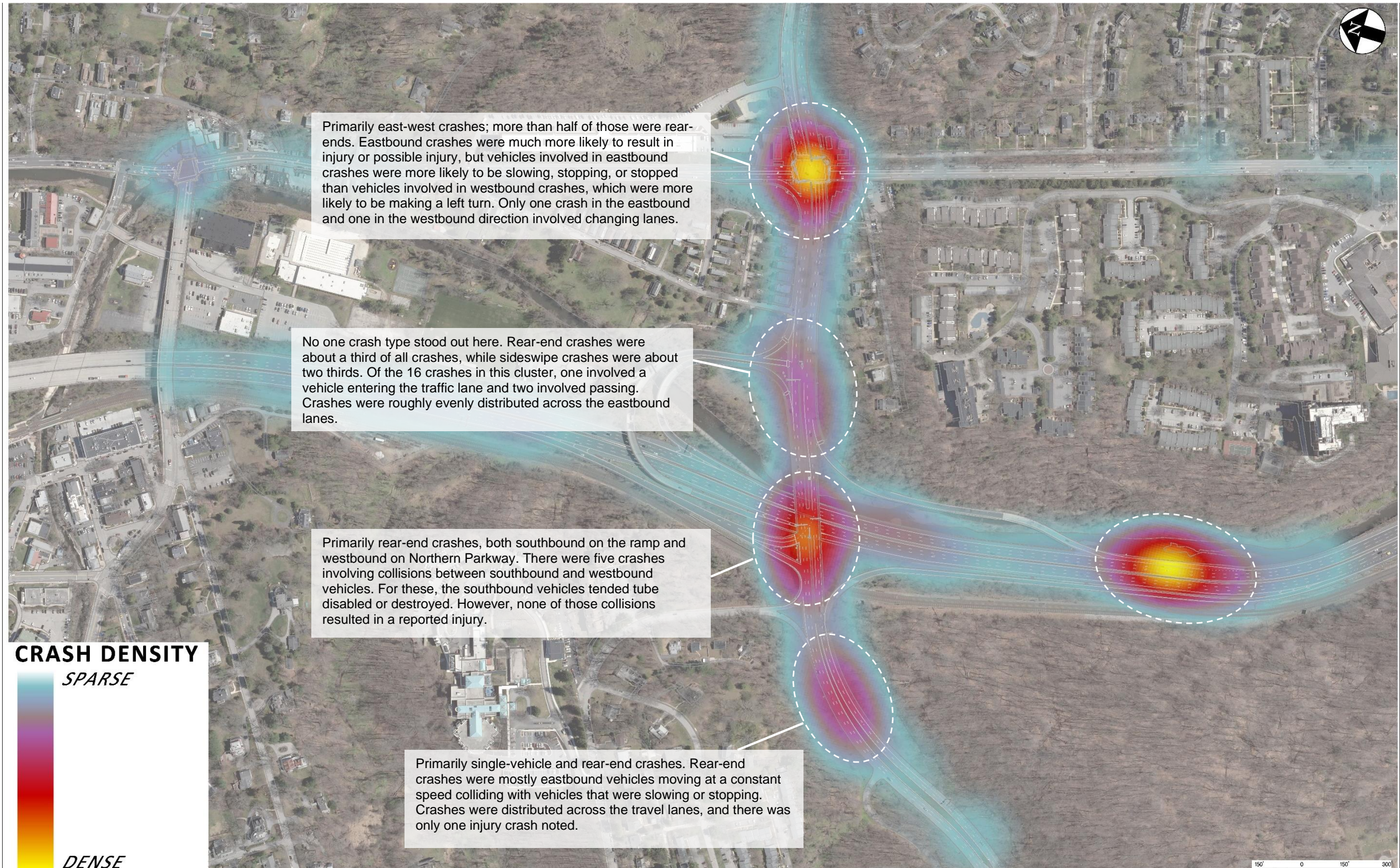


Figure 10. Existing Crash Patterns

Key Findings of Traffic Operations Existing Conditions Analysis

Eastbound Northern Parkway queuing is exacerbated by mid-block lane changes and left turn bay spillovers that temporarily impede through travel lanes (**Figure 11**). These blockages cause temporary but lengthy queues to quickly develop and delays to increase. However, the system is able to recover within a few cycles reducing the reported intersection delays for the total analysis period. Field observations indicate that weaving maneuvers between the I-83 northbound off ramp and the intersection at Falls Road cause significant congestion in the eastbound direction of Northern Parkway. This traffic movement requires two lane changes in approximately 500' under heavily congested conditions. Approximately one quarter of all off-ramp vehicles are destined to make the left turn at Falls Road accounting for approximately one-half of all eastbound left turns at Falls Road. These rates were found to be consistent during both the AM and PM peak hours with approximately 160 vehicles per hour (vph).⁹



Figure 11. Eastbound Northern Parkway



Figure 12. Westbound Northern Parkway

Westbound Northern Parkway queuing at the Falls Road intersection is the result of downstream metering and uneven lane utilization. Consistent with field observations, this congestion is caused by the downstream diverge to the I-83 on-ramps. Approximately one quarter of the traffic on westbound Northern Parkway approaching I-83 has demand for the off-ramp while one 1 out of the 3 travel lanes serve this movement. With the single lane being near capacity, coupled with last minute lane changes, cause significant queuing which spills back through the Falls Road signal metering westbound through and right, southbound right, and to a lesser extent the northbound left movements (**Figure 12**).

⁹ See Appendix C.

Falls Road/Northern Parkway Corridors Study
Part 1. The Study Area – Existing Conditions

Table 2. Summary of Existing Conditions by Intersection

NODE	INTERSECTION	APPROACH	MOVEMENT	EXISTING CONDITIONS		
				AM (PM)		
				DELAY	LOS	V/C
1	Falls Road & W Lake Ave	Control Type		Signal		
		Overall		27.1 (21.0)	C (C)	0.76 (0.71)
		Eastbound	left-through-right	30.5 (24.1)	C (C)	0.08 (0.07)
		Westbound	left-through	48.7 (37.1)	D (D)	0.78 (0.73)
			right	33.6 (25.3)	C (C)	0.40 (0.23)
		Northbound	left	21.7 (15.3)	C (B)	0.09 (0.04)
			through-right	38.4 (26.0)	D (C)	0.81 (0.73)
		Southbound	left	19.6 (12.8)	B (B)	0.67 (0.62)
through-right	8.4 (7.5)		A (A)	0.45 (0.34)		
2	Falls Road & Smith Ave	Control Type		Signal		
		Overall		53.0 (24.5)	D (C)	0.55 (0.49)
		Eastbound	left	59.4 (65.4)	E (E)	0.12 (0.39)
			right	22.0 (40.5)	C (D)	0.13 (0.42)
		Northbound	left	14.8 (4.5)	B (A)	0.19 (0.32)
			through	1.4 (1.5)	A (A)	0.36 (0.38)
		Southbound	through-right	95.1 (39.6)	F (D)	1.02 (0.50)
		3	Falls Road & Kelly Ave	Control Type		Signal
Overall				46.7 (37.0)	D (D)	1.07 (0.74)
Eastbound	left			43.6 (64.4)	D (E)	0.45 (0.69)
	right			40.6 (39.6)	D (D)	0.78 (0.39)
Northbound	left			166.6 (39.2)	F (D)	1.19 (0.75)
	through			38.9 (28.8)	D (C)	0.55 (0.54)
Southbound	through			16.3 (20.0)	B (C)	0.80 (0.42)
	right			1.3 (41.7)	A (D)	0.20 (0.18)
4	Greenspring Ave & Northern Parkway	Control Type		Signal		
		Overall		49.2 (23.4)	D (C)	0.98 (0.87)
		Eastbound	through	91.7 (31.6)	F (C)	1.15 (0.97)
			right	12.6 (10.1)	B (B)	0.33 (0.13)
		Westbound	left	38.7 (21.4)	D (C)	0.79 (0.49)
			through	7.0 (7.1)	A (A)	0.66 (0.47)
		Northbound	left	37.2 (36.3)	D (D)	0.45 (0.63)
			right	34.5 (31.7)	C (C)	0.06 (0.21)
5	Northern Parkway & I-83 SB Ramps	Control Type		Signal		
		Overall		18.3 (15.6)	B (B)	1.00 (0.70)
		Eastbound	through	12.1 (11.7)	B (B)	0.48 (0.52)
			right	14.1 (1.9)	B (A)	0.95 (0.63)
		Westbound	through	10.0 (10.4)	A (B)	0.68 (0.55)
		Southbound	left	44.3 (46.0)	D (D)	0.35 (0.37)
			right	84.7 (71.7)	F (E)	0.94 (0.86)
		6	Northern Parkway & I-83 NB Ramps	Control Type		Signal
Overall				27.7 (14.1)	C (B)	1.09 (0.96)
Eastbound	left			73.2 (66.3)	E (E)	0.93 (0.89)
	through			0.2 (0.3)	A (A)	0.42 (0.48)
Westbound	through			6.9 (9.3)	A (A)	0.61 (0.43)
	right			100.3 (38.2)	F (D)	1.18 (1.00)
Southbound	right			1.4 (1.6)	A (A)	0.57 (0.59)

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Table 2. Summary of Existing Conditions by Intersection (continued)

NODE	INTERSECTION	APPROACH	MOVEMENT	EXISTING CONDITIONS		
				AM (PM)		
				DELAY	LOS	V/C
7	Falls Road & Northern Parkway	Control Type		Signal		
		Overall		96.9 (76.7)	F (E)	1.13 (0.98)
		Eastbound	left	88.3 (84.9)	F (F)	0.91 (0.93)
			through-right	47.4 (42.1)	D (D)	0.84 (0.90)
		Westbound	left	99.1 (70.1)	F (E)	0.84 (0.72)
			through-right	139.5 (138.1)	F (F)	1.25 (1.15)
		Northbound	left	63.2 (43.7)	E (D)	0.85 (0.59)
			through-right	53.7 (62.0)	D (E)	0.53 (0.75)
		Southbound	left	44.2 (70.0)	D (E)	0.61 (0.86)
through	61.9 (55.6)		E (E)	0.78 (0.47)		
right	206.0 (79.1)		F (E)	1.28 (0.84)		
8	Roland Ave & Northern Parkway	Control Type		Signal		
		Overall		69.5 (44.2)	E (D)	1.00 (0.85)
		Eastbound	left	64.4 (64.2)	E (E)	0.58 (0.69)
			through-right	40.3 (35.5)	D (D)	0.90 (0.90)
		Westbound	left	>300 (64.3)	F (E)	1.49 (0.65)
			through-right	54.8 (30.8)	D (C)	0.92 (0.61)
		Northbound	left	180.0 (146.3)	F (F)	1.18 (1.04)
			through	40.4 (58.4)	D (E)	0.29 (0.57)
			right	31.3 (37.4)	C (D)	0.41 (0.34)
		Southbound	left	69.1 (71.8)	E (E)	0.48 (0.35)
			through	58.1 (62.3)	E (E)	0.81 (0.53)
right	48.0 (61.7)		D (E)	0.43 (0.40)		
9	Falls Rd & Cold Spring Ln	Control Type		Signal		
		Overall		63.5 (55.1)	E (E)	0.84 (0.73)
		Eastbound	left	51.0 (42.7)	D (D)	0.62 (0.56)
			through	71.4 (59.3)	E (E)	0.93 (0.88)
			right	46.7 (41.3)	D (D)	0.31 (0.29)
		Westbound	left	64.6 (46.8)	E (D)	0.79 (0.46)
			through-right	65.4 (53.6)	E (D)	0.91 (0.76)
		Northbound	left	72.1 (63.2)	E (E)	0.85 (0.76)
			through-right	61.1 (59.9)	E (E)	0.72 (0.71)
		Southbound	left-through	59.7 (55.1)	E (E)	0.74 (0.48)
right	46.3 (48.7)		D (D)	0.11 (0.06)		

Infrastructure Condition Assessment

Pavement, streetlights, roadway signs and other appurtenances were field reviewed for obvious defects. The following significant deficient conditions are noted:

- The concrete section of Northern Parkway between Falls Road and Roland Avenue was rehabilitated in 2015 and is already showing signs of disrepair (spalling, cracking, uneven joints). The asphalt sections of both **Northern Parkway and Falls Road have not been milled and overlaid since 2008**; resurfacing will be necessary in the next five to seven years.
- Most signage in the area does not meet FHWA's requirements for retro reflectivity which is critical to nighttime visibility.¹⁰ Of particular importance is guideway signage leading to and from interstate roadways which occur at higher speeds and thus have a greater crash severity. In the study area, **all of the guide signs are worn and faded to the point at which some are barely visible even during daylight. It is critical that these signs be replaced as part of any improvement project.**
- A condition assessment of the JFX was not performed as part of this study except with respect to the ramps leading to the freeway and the bridges crossing over it. Two bridges span the JFX as well as the MTA Light Rail line and the Jones Falls: Northern Parkway (BC 3209) and Kelly Avenue (BC 3406); both span over I-83.
 - The Northern Parkway bridge includes the ramps to and from I-83 and is a three-span multi-beam steel bridge built in 1962 and rehabilitated in 1988. The bridge was last inspected in January 2019 and found to be in satisfactory condition with some minor corrosion, spalls and hairline cracks in the superstructure and substructure but no conditions warranting immediate corrective action.
 - The Kelly Avenue bridge is a 16-span multi-beam bridge originally constructed in 1925 and rehabilitated in 1979. At the 2018 biennial inspection, the bridge deck was found to be in fair condition, the superstructure was found to be in poor condition with the substructure in fair condition. Heavy corrosion was apparent and joint seals were in poor condition; the seals were replaced in 2019. Full height cracks on the abutment walls, bearing pedestals and pier caps and columns were found along with exposed and corroded reinforcing bars. Significant reconstruction is not expected for either bridge within the planning period.
- Approximately **950 linear feet of safety fencing is in poor condition** and needs to be replaced on the Northern Parkway bridge over the JFX.
- When Falls Road was resurfaced in the past few years, roadway milling and base repair was not deep enough to allow curbs to rise to their minimum height of 8 inches above top of payment. This creates both a dangerous safety condition for run-off-the-road type crashes as the barrier to sidewalk and fixed objects is ineffective at a lower height. In low lying areas, a curb that is too low does not always capture and direct stormwater to inlets, potentially creating nuisance run-off to nearby properties. A similar situation occurred during the resurfacing of Roland Avenue in 2015; nearly three miles of curb reconstruction was necessary after the project had been completed.
- Sidewalk conditions vary within the study area, but concerns such as uneven or chipped concrete, sign, signal, and light poles that inhibit passage, and overgrown vegetation appear throughout the

¹⁰ Nationally, only about 25% of travel occurs in dark conditions, but 50% of crashes occur in dark conditions. Source: FHWA Minimum Retroreflectivity Guidance, August 2012.

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study area. These obstructions impair ADA compliance at multiple locations. In addition, there are approximately 56 locations where detectable warning surfaces must be installed to improve ADA compliance.

- Pavement marking conditions vary throughout the study area. In particular, crosswalk markings on the east and west approaches to the Northern Parkway/Falls Road intersection, the west and south approaches to the Kelly Avenue/Falls Road intersection, and across the I-83 ramps are in moderate to poor condition.

Transit Service

Baltimore LightRail Link and five BaltimoreLink bus routes traverse the study area with several other routes crossing Northern Parkway. **Table 3** summarizes transit service within the study area.

Table 3. Study Area Transit Service Summary

ROUTE NAME	LOCALLINK 28		LOCALLINK 30		LOCALLINK 33		LOCALLINK 34		LOCALLINK 51		LOCALLINK 94		LOCALLINK 95		LIGHT RAILLINK	
Study Area Destinations Served	• Cold Spring Ln Corridor • Cold Spring Light Rail		• Sinai Hospital • Northern/ Falls • Northern/ Charles		• Mount Washington • Northern/ Falls • Northern/ Charles		• Falls Rd Light Rail • Mount Washington		• Northern/ Charles		• Sinai Hospital • Mount Washington • Falls/ Cold Spring		• Northern/ Roland		• Falls Rd • Mount Washington • Cold Spring Lane	
Other Destinations Served	• Rogers Ave Metro • Morgan State • Moravia Rd		• Rogers Ave Metro • Belvedere Square • Hollander Ridge		• Belvedere Square • Overlea		• Rogers Ave Metro • Howard Park • Westview		• Towson • GBMC • JHU • Penn Sta • Downtown		• Hampden • State Ctr • Downtown • Ft McHenry		• Roland Park • JHU • Penn Sta • Downtown		• Hunt Valley • Downtown • BWI Airport • Cromwell	
AM Peak Average Headway	0:15		0:15		0:39		0:35		0:30		0:38		0:27		0:09	
PM Peak Average Headway	0:15		0:15		0:38		0:41		0:30		0:40		0:30		0:10	
Direction	EB	WB	EB	WB	EB	WB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
Daily Trips	52	50	68	70	29	29	21	21	34	33	30	31	20	20	93	94

Table 4 (**Figure 13**) identifies the approximately 30 bus stops in the study area. Americans with Disabilities Act (ADA) compliance is a concern at many bus stops in the area: one stop does not have any sidewalk access, three stops do not have a paved boarding area, only seven have benches, and only three have shelters. In addition, there are three bus stop pairs that are more than 400 feet from a signalized pedestrian crossing: Falls Road at Appleby Avenue, Falls Road at Mattfeldt Avenue, and Falls Road at Edgevale Road/Englewood Road.

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Table 4. Bus Stop Access and Infrastructure

Table 4. Bus Stop Access and Infrastructure		Routes Served						Stop Access and Infrastructure											
		30	33	34	94	95	51	Sign	Info Box	5 x 8 Landing Pad	Paved Boarding Area	Sidewalk	Bench	Shelter	Map	Real-Time Info Display	Trash Can	Concrete Bus Stop Pad	Distance to Ped Crossing
Stop Location																			
SB	Falls Rd and Lake Ave																		220'
NB	Falls Rd and Lake Ave																		320'
SB	Falls Rd and Appleby Ave																		440'
NB	Falls Rd and Appleby Ave																		620'
SB	Falls Rd and Smith Ave																		120'
NB	Falls Rd and Bellemore Rd																		230'
EB	Kelly Ave and Falls Rd																		100'
WB	Kelly Ave and Falls Rd																		140'
SB	Falls Rd and Mattfeldt Ave																		1050'
NB	Falls Rd and Mattfeldt Ave																		1000'
SB	Falls Rd and Northern Pkwy																		10'
NB	Falls Rd and Northern Pkwy																		140'
NB	Falls Rd and Falls Rd Terr																		520'
SB	Falls Rd and Edgevale Rd																		870'
NB	Falls Rd and Englewood Rd																		970'
SB	Falls Rd and Cross Keys Blvd																		80'
NB	Falls Rd and Elmwood Rd																		10'
WB	Northern Pkwy and Rogers Ave																		1700'
EB	Northern Pkwy and Falls Rd																		180'
WB	Northern Pkwy and Falls Rd																		30'
EB	Northern Pkwy and Roland Ave																		140'
WB	Northern Pkwy and Roland Ave																		110'
SB	Roland Ave and Northern Pkwy																		120'
NB	Roland Ave and Northern Pkwy																		130'
EB	Northern Pkwy and Charles St																		290'
WB	Northern Pkwy and Charles St																		10'
SB	Charles St and Northern Pkwy																		95'
NB	Charles St and Northern Pkwy																		90'

Note: Red=route served, blue=type of access provided

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Figure 13. Bus Stop Access

Part 2. Alternatives Developed and Considered

This section describes the alternatives developed and considered to meet the purpose and need for the project. Much of this section is devoted to traffic and roadways operations and safety issues as the options to achieve a state of good repair and improve conditions for bicyclists, pedestrians and transit users are more straightforward and fully described in their respective appendices.

State of Good Repair

Improving the condition of transportation assets to a state of good repair is one of the goals of the Falls Road/Northern Parkway corridor study. The infrastructure condition assessment describes some of the most pressing needs for improvement. **Appendix D** provides plan sheet level detail of all deficiencies noted in the study corridor.

Bicycle, Pedestrian and Transit Improvements

The Falls Road/Northern Parkway Corridor Study Area is not just the realm of motor vehicles; during a typical day, thousands of people walk, cycle, and/or ride bus or light rail transit through the study area.¹¹ While Falls Road and Northern Parkway are the primary automobile corridors through the study area, they are not necessarily the routes that people choosing non-auto modes may traverse. A technical memorandum included as **Appendix C** includes a range of alternatives for improving transit services, and bicycle and pedestrian access and mobility.

Traffic and Roadways

Findings from the existing conditions analysis revealed the core Northern-Falls study area is over-saturated as a result of traffic flow impedances caused by excessive lane changing and unequal lane utilization. In response to the findings, 11 initial sketch concept ideas that could address congestion problems through traffic flow management, roadway capacity additions, and/or Traffic Demand Management (TDM) strategies were developed. A four-phase screening and evaluation process was developed to reduce and package the concepts into potential build alternatives that can be moved into conceptual design.

A four-step process developed alternatives to improve traffic operations and safety in the vicinity of Falls Road and Northern Parkway as follows:

- Step one **developed and screened approximately 11 sketch-level concepts** to assess high-level environmental impacts and constructability and to identify potential safety and operational benefits of each.
- Step two **screened each concept in isolation** using HCM (Synchro) to determine if the concept provided enough additional capacity in 2030 to improve operations relative to existing conditions.
- Step three **grouped the concepts that passed the initial traffic and environmental screening into packages** that could address multiple operational concerns based on the project team's engineering judgment.
- Step four performed VISSIM microsimulation to determine the total operational benefit of the packaged alternatives.

¹¹ This does not include latent demand, i.e. pedestrian, bicycle, and transit travel that would take place if additional service or facilities were in place.

Initial Concepts and Feasibility/Benefit Screening

Eleven concepts were initially developed for their potential to improve traffic operations and capacity in the study area with the emphasis being on improvements along Northern Parkway approaching Falls Road from the east and I-83 from the west. If screened favorably, the alternatives could be used individually or packaged with other concepts to improve traffic conditions in the study area. These concepts were given an initial screening considering the following:

- **Improve Safety** – The alternative should reduce the number and severity of crashes in the study area.
- **Improve Traffic Operations** – An alternative must potentially improve traffic operations for one or more movements without degrading other movements in the study area in 2030. The results of this analysis are shown in Table 5.
- **Minimize Operational Impacts to I-83** – The free and safe flow of traffic on the Interstate Highway System must be maintained, if not improved, in the study area.
- **Minimize Impacts to the Human and Natural Environment** – The alternative should avoid or minimize right-of-way acquisition, impacts to historic and cultural resources, forest cover loss, alteration of steep slopes; discourage speeding and cut-through traffic in nearby communities; promote bicycle and pedestrian access.
- **Fiscal Responsibility** – The alternative should maximize operational and safety benefit for transportation system users while avoiding or minimizing major cost drivers such as utility relocation and new or altered retaining walls and structures.

Due to the array of issues identified in the existing and 2030 no build analyses, the concepts were organized into three groups based upon the specific issue or location they were aimed to mitigate: regional access improvements, Falls Road intersection improvements, and I-83 ramp improvements.

Regional Access Improvement Concepts

Four concepts were developed to evaluate perceived gaps in I-83 access between Northern Parkway and I-695. (See **Figure 14**)¹². Using the Baltimore Metropolitan Council's travel demand forecasting model and the data shown in Table 1 trips were "re-assigned" to see which of the three interstate access point concepts would yield the greatest reduction in trips through the intersection of Falls Road at Northern Parkway. Model results are shown below.

¹² For the purpose of simplicity, only northbound travel was measured for this analysis.

Table 5. Phase 1 Screening summary

PHASE 1 SCREENING SUMMARY TABLE				
LOCATION	SKETCH CONCEPT	OUTCOME	REASONING	DETAILS
Regional Concepts	I-83 at Old Pimlico Road Connection	No Further Analysis	Operations	No further analysis is recommended due to the limited reduction in traffic volumes for the Northern Parkway/Falls Road area estimated by the preliminary travel forecasting analysis.
	I-83 at Ruxton Road	Request Further Analysis by MDOT SHA	Operations	Team will request further study be performed by MDOT SHA to quantify the operational impacts of the proposed northbound ramp termini signalization.
	Signal Installation	Further Analysis Recommended	Operations	Further study, in the form of a sensitivity analysis, is recommended to determine the benefits of reduced traffic within the core study area as a result of a proposed NB off-ramp being constructed at Kelly Avenue.
Falls Road at Northern Parkway Intersection	Jug Handle Intersections	No Further Analysis	Constructability	No further analysis is recommended on any intersection quadrant due to potential impacts to private property and/or topography which could make construction cost prohibitive.
	Median U-Turn Lane Intersections	Further Analysis Recommended (for N & E legs only)	Varies	Further analysis is recommended on the north and west leg MUT concepts due to the reduced potential for detrimental impacts to private property and current operations, while showing a high potential benefit from applicable left turn restrictions.
	Lane Additions	Further Analysis Recommended	Constructability Operations	Further analysis is recommended to determine what, if any, targeted turn lane additions can improve intersection capacity without significant impacts to private property.

PHASE 1 SCREENING SUMMARY TABLE				
LOCATION	SKETCH CONCEPT	OUTCOME	REASONING	DETAILS
Northern Parkway at I-83 Interchange	Westbound Choice Lane	Further Analysis Recommended	Constructability	Further analysis is recommended to determine the operational impacts of creating a westbound choice lane that would allow a dual right turn movement onto the I-83 on-ramps.
	Dual Access Eastbound with Channelization	Further Analysis Recommended	Operations	Further analysis is recommended to determine the operational impacts of introducing a new turning movement to the I-83 NB ramp termini.
	Eastbound Channelization	Further Analysis Recommended	Constructability	Further analysis is recommended to determine the operational impacts of introducing channelization eastbound to prevent vehicles from the NB off-ramp making a left turn at Falls Rd.
	Eastbound Alternate Merge Signal	Further Analysis Recommended	Operations	Further analysis is recommended to determine the operational impacts of an alternate merge condition eastbound.
	Single Point Urban Interchange (SPUI)	Further Analysis Recommended	Constructability	Further analysis is recommended to determine the constructability and operational impacts of reconfiguring the interchange into a SPUI.

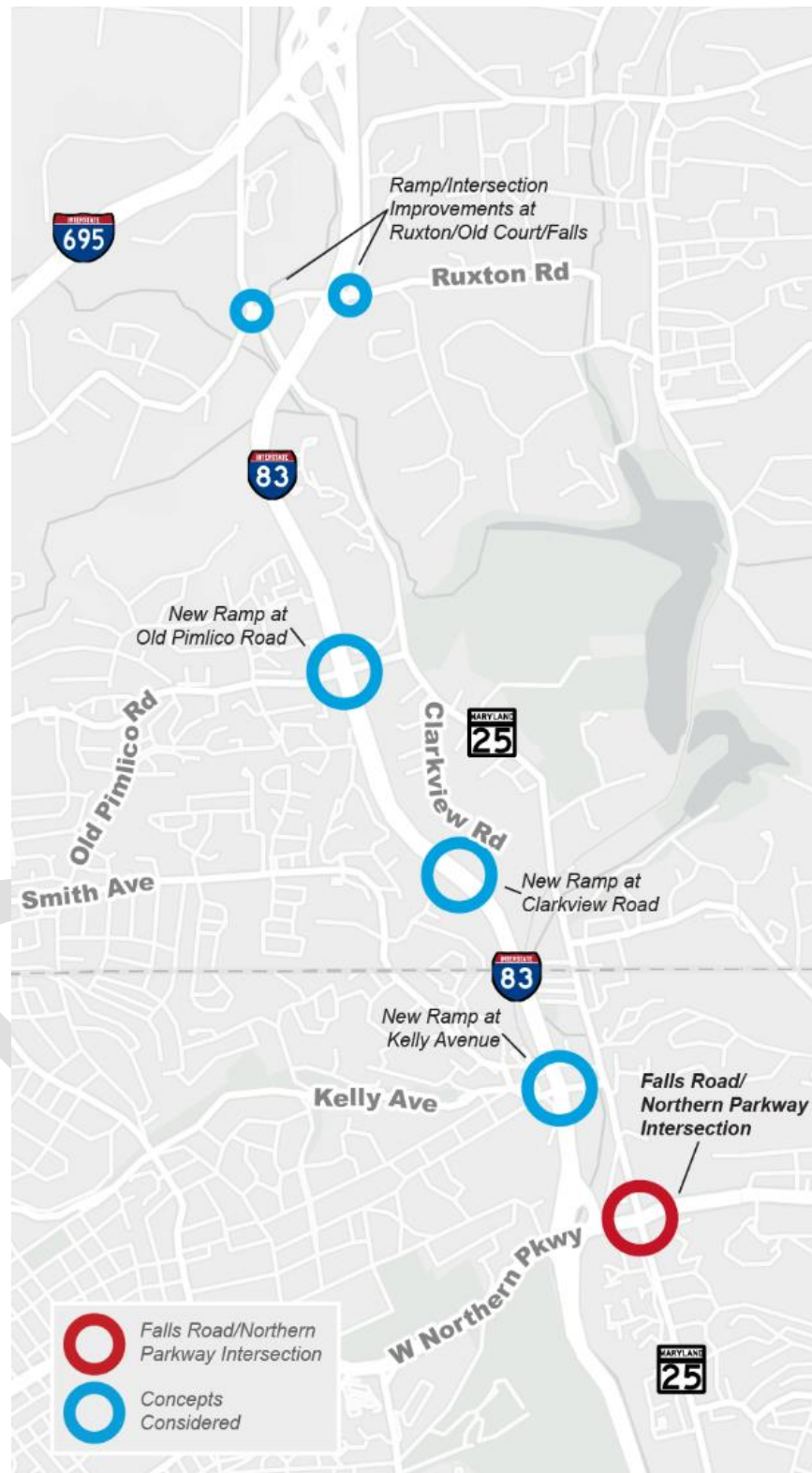


Figure 14. Concepts Addressing Gaps

Falls Road Intersection Improvement Concepts

To address the limited capacity at the intersection, the following sketch level concepts were considered in order to reduce the number of left turn signal cycles required and thus increase throughput:

- **Jug handle Intersections:** Jug handle intersections (**Figure 15**) increase intersection capacity through the restriction of left turn movements, and subsequent reduction in intersection phases, which “frees up” time for failing movements. Left turns would then be diverted through newly created loop roadways and served by two (2) through movements rather than one (1) left turn.
- **Median U-Turn (MUT) Intersections:** Median U-turn intersections were considered on each of the four legs of the Falls Road and Northern Parkway intersection. As shown in **Figure 16**, MUT intersections can further increase the capacity of a major intersection through the restriction of up to two (2) left turn movements and diversion through a newly created downstream signal-controlled U-Turn movement. MUT intersections often require a smaller footprint to that of Jug Handle intersection designs.
- **Lane Additions:** More traditional capacity improvements in the form of turn lane additions were also considered at the Falls and Northern Parkway intersection.



Figure 15. Jug Handle Intersection



Figure 16. Median U-Turn Intersection

Northern Parkway at I-83 Interchange Concepts

The following sketch level concepts were developed to address weaving and lane utilization issues along eastbound and westbound Northern Parkway, respectively:

- **Westbound Choice Lane:** With an equal split in traffic volumes at the westbound Northern Parkway diverge to I-83, the westbound choice lane concept re-assigns lane configurations to better match traffic patterns. **Figure 17** shows the sketch level westbound choice lane concept developed to mitigate unequal westbound lane utilization.
- **Eastbound Access Control (Channelization) with Dual Access:** Overlapping channelization between the eastbound left turn lane to Falls Road and



Figure 17. Westbound Choice Lane

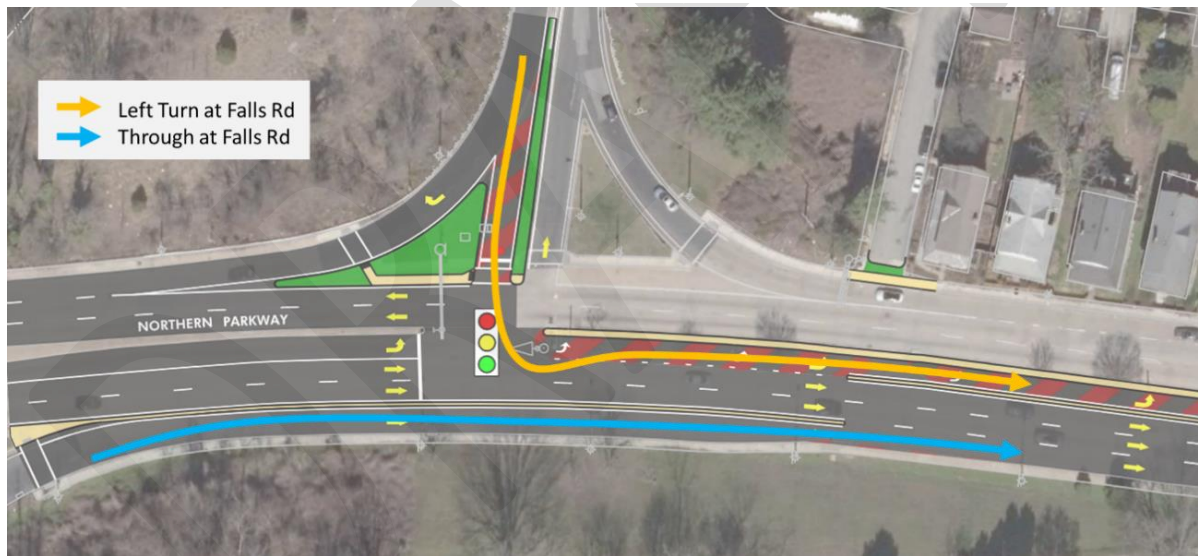


Figure 18. Eastbound Channelization With Dual Access Concept

the I-83 NB off-ramp was considered to restrict access and eliminate cross-over movements with a physical barrier. To continue serving demand for the eastbound left turn lane to Falls Road northbound, dual access was considered in the form of a new southbound left turn lane from the I-83 northbound off-ramp that currently serves movement to westbound Northern Parkway only. **Figure 18** shows the concept sketch of the eastbound channelization and dual access.

- **Eastbound Access Control (Channelization):** The eastbound channelization only concept was considered without the dual access in the event that the addition of a new turn phase at the ramp termini signal proved to be detrimental to traffic operations.

- **Eastbound Alternate Merge Signal:** An eastbound alternate merge concept (**Figure 19**) was considered for its potential to control eastbound weaving movement between the I-83 northbound off ramp and Falls Road with the introduction of new signal control.



Figure 19. Eastbound Alternate Merge Signal Concept

- **Single Point Urban Interchange (SPUI):** If a complete redesign of the interchange proved to be feasible near term, a SPUI type interchange was considered as a sketch level concept. As shown in **Figure 20**, Single Point Urban Interchange designs offer less complex interchange ramp geometry within a reduced footprint, providing additional space for queue management and lane changes between adjacent signals.



Figure 20. Single Point Urban Interchange
Photo: Google Earth

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Part 2. Alternatives Developed and Considered

Table 5. CONCEPT EVALUATION SUMMARY (continued)

Concept Name			Summary of Impacts	Summary of Advantages	Summary of Drawbacks
Regional Concept)	1	New I-83 Ramp(s) at Kelly Avenue	Would add impervious surface, require extensive construction for the new ramp, and may have property impacts at the Meadowbrook Aquatic Center.	Would remove northbound Falls Road and Mount Washington-bound traffic from the Falls Road/Northern Parkway intersection altogether.	New ramp would need to be constructed and would have traffic impacts along Kelly Avenue and I-83, with a short (~500 to 700 foot) weave between the Northern Parkway NB on-ramp and the Kelly Avenue NB off-ramp.
Local Capacity Improvements – Eastbound Northern Parkway	2	Separate I-83 NB Ramp Movements to NB Falls Road	Adding the new southbound left turn lane would add impervious surface but have no property impacts.	Would eliminate the weave from I-83 NB off-ramp to the left turn lane from EB Northern Parkway to NB Falls Road.	New southbound approach to the I-83 NB ramp intersection along Northern Parkway would require a new signal phase and cause significant delay for through traffic, especially westbound, on Northern Parkway.
	3	Eastbound Channelization Only	Minimal environmental impacts and no property impacts.	Would eliminate the weave from I-83 NB off-ramp to the left turn lane from EB Northern Parkway to NB Falls Road.	Restricting the movement from the I-83 NB off-ramp to NB Falls Road without providing a new, designated way to make that movement would likely lead to through traffic diverting onto local streets. Would contribute to eastbound congestion along Northern Parkway by limiting opportunities for vehicles intending to turn right onto southbound Falls Road to merge into the right lane.
	4	Signalize I-83 NB Ramp/Northern Parkway Weave	Signalizing the I-83 NB off-ramp will require widening, which will increase impervious surface but will not have any property impacts.	Would eliminate the weave from I-83 NB off-ramp to the left turn lane from EB Northern Parkway to NB Falls Road.	Queues at the new signal would develop along the I-83 NB off-ramp and along eastbound Northern Parkway.
Local Capacity Improvements – Westbound Northern Parkway	5	Choice Lane from WB Northern Parkway to I-83 NB/SB Ramp	Adding the choice lane will require widening of the I-83 NB/SB on-ramp, which will increase impervious surface but will not have any property impacts.	Would allow for more even lane utilization along westbound Northern Parkway and eliminate the need for all I-83 bound vehicles to merge into the single right lane.	Would require construction for ramp widening on the I-83 NB/SB on-ramp.

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Concept Name			Summary of Impacts	Summary of Advantages	Summary of Drawbacks
	6	Removal of Channelization from SB Falls Road to WB Northern Parkway	Net decrease in impervious surface and no property impacts.	Would slow vehicle turning speeds and eliminate the need for pedestrians to cross the channelized right turn lane.	<p>Most pedestrian movements at the northwest corner of the intersection are crossings of Falls Road in a westbound direction undertaken while transferring buses; removing the channelization would make this a longer crossing, both in distance and number of lanes. Removing channelization would also lead to a minor increase in travel times for southbound drivers from Falls Road onto I-83.</p> <p>Would increase the distance most pedestrians have to cross and would lead to a minor increase in travel times for drivers making the right turn from southbound Falls Road onto westbound Northern Parkway.</p>
Local Capacity Improvements - Multiple Approaches	7	Additional right turn lanes	Would add impervious surface along Falls Road, require reconfiguration and construction of a retaining wall at the Shell station, and would have property impacts along Northern Parkway.	Would increase the capacity of the intersection to accommodate existing and forecasted traffic volumes.	Would lead to longer pedestrian crossings of the north and east approaches to the intersection, and would require construction of a new retaining wall and reconfiguration of the Shell parking lot to accommodate the new eastbound right turn lane.
Alternative Intersection Designs	8	Median U-Turn on Northern Parkway east of Falls Road	Would add impervious surface have extensive widening/retaining wall construction requirements and property impacts along Northern Parkway.	Would allow for removal of left-turning traffic in the northbound and eastbound directions from the Falls Road/Northern Parkway intersection.	Would have significant construction and property impacts for the required loon and additional lane westbound along Northern Parkway east of Falls Road.
	9	Median U-Turn on Falls Road north of Northern Parkway	Would add impervious surface and have require retaining wall construction for the loon along Falls Road, but would not have any property impacts.	Would allow for removal of left-turning traffic in the westbound and northbound directions from the Falls Road/Northern Parkway intersection.	Would have significant construction and property impacts for the required loon, and would exacerbate southbound congestion by adding additional vehicles to the already overcapacity southbound approach to the Falls Road/Northern Parkway intersection.
Interchange Replacement	10	Single-Point Urban Interchange	Would require extensive including construction of new I-83 ramps and replacement of the Northern Parkway ramps and would likely result in an increase in impervious surface, but would likely not have any property impacts.	Would increase the capacity of the interchange while reducing the number of signal phases required and providing additional distance between the interchange ramps and the Falls Road/Northern Parkway intersection.	Would require significant construction to replace the interchange, and the existing bridge is in good condition with no pending need for replacement.

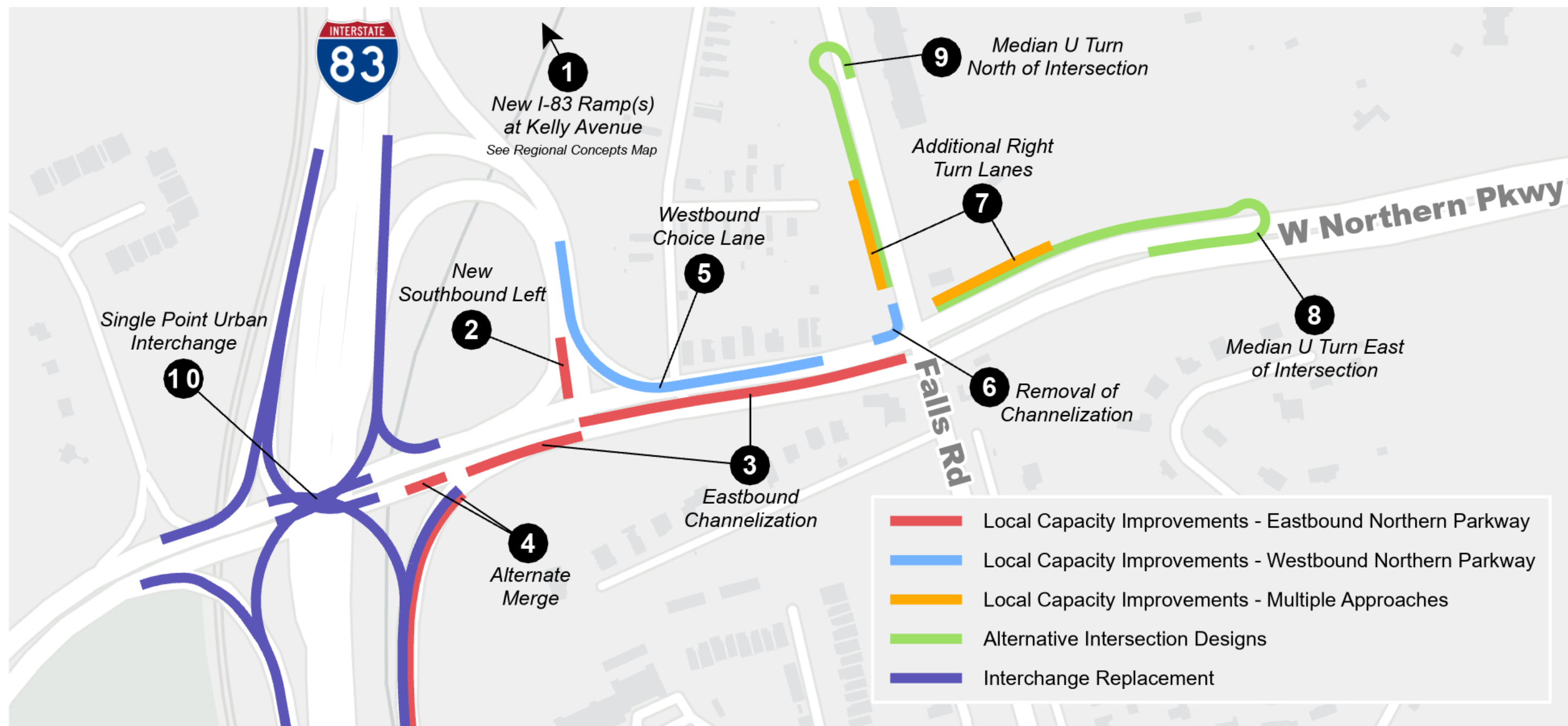


Figure 21. Concept Options

Alternatives Retained for Detailed Study

As described above, the core problems to be solved with respect to traffic operations and safety are westbound queuing and merging on Northern Parkway approaching Falls Road and the JFX; and the reducing the “friction” of traffic between northbound traffic existing the JFX to go east on Northern Parkway or north onto Falls Road and competing eastbound traffic along Northern Parkway which builds to peak volume from Greenspring Avenue.

Westbound Northern Parkway

Based on the screening analysis, there is only one viable option (other than taking no action) for improving the queuing, merging, and weaving approaching Falls Road and the JFX. Vehicles travelling west along Northern Parkway must currently get into the right (northernmost) lane to use the I-83 exit ramp which splits for northbound and southbound travel. As a result of the heavy volumes, vehicles often queue well before Falls Road or attempt a late merge just after Falls Road to access the ramp. To create a westbound choice lane as shown in **Figure 22**, the I-83 on-ramp approaching from the from westbound Northern Parkway would be widened from its existing width of 20' (approx.) to a 30' width to allow for two lanes of traffic.

A new traffic signal would control movements onto the on-ramps and allow eastbound traffic from Northern Parkway to access the on-ramp to I-83 northbound. Parking along westbound Northern Parkway would be restricted at all times and Mattfeldt Avenue would be converted to right-in, right-out only.

Measures to mitigate the parking and access/circulation impact to the Mattfeldt community are discussed in Part 3 (Recommended Improvements.)



Figure 22. Westbound Choice Lane

Eastbound Improvements Northern Parkway at JFX and Falls Road

The initial screening ruled out a potential second exit from northbound JFX to eastbound Northern Parkway due to concerns about driver expectation and potential ramp queuing on mainline JFX and sight distance on the ramp where traffic would diverge east or west at a traffic signal to Northern Parkway. (Shown as concept #3 on **Figure 21**). In that concept motorists travelling eastbound on Northern Parkway would be channelized in the exit lane and not be able to turn left onto Falls Road.

Two other alternatives were more fully developed for detailed traffic operations analysis: (Alt 1) retain the **eastbound channelization** without any access to the turn lanes for northbound Falls Road; and, (Alt 2) an **alternating merge** for traffic exiting the JFX and for eastbound traffic on Northern Parkway. Under both alternatives, the impacts to the natural environment are very minor. Additional measures to manage operations and safety at the intersection are warranted as well discussed in Part 3 (Recommended Improvements.)

Alt 1: Eastbound Channelization from Northbound JFX Ramp

Under this alternative, all traffic exiting the JFX at Northern Parkway eastbound would be forced to continue through the intersection at Falls Road. A concrete median would restrict motorists from weaving across three lanes to turn left (north) onto Falls Road. To reach destinations on Falls Road north of Northern Parkway, motorists could exit the JFX at I-83 and continue north; exit at Ruxton Road and return south; or, continue east on Northern Parkway and use an alternate route (Roland Avenue to Lake Avenue, Charles Street, etc.).

Traffic analysis indicates that the eastbound channelization actually worsens congestion and delay as a whole to LOS F, but particularly for travel in the eastbound direction for vehicles seeking to turn south onto Falls Road. With ramp volumes approaching capacity, vehicles travelling eastbound on the mainline of Northern Parkway have difficulty finding gaps in the short merge area to turn right onto Falls Road. This results in frequent stops and last-minute lane changes, significant delays (2 minutes or more) and queueing spillbacks onto I-83.

Eastbound congestion is not realized in the PM peak hour due to reduced demand for Falls Road southbound. No significant changes in LOS are forecasted at intersections east of Falls Road even though there is some volume increase due to the channelization.

Alt 2: Eastbound Alternate Merge Signal

Under this alternative, traffic exiting the JFX would be controlled by a traffic signal, as would eastbound traffic on Northern Parkway just before the exit ramp. The signals would alternate between ramp and mainline traffic, allowing vehicles to continue to the intersection of Falls Road where all turning movements would occur as they do today. Traffic operations analysis indicates that Alternative 2 results in significant changes LOS compared to existing and 2030 no-build conditions.

Because both build alternatives propose the westbound choice lane, alternative 2 intersection and westbound travel time results indicate similar improvements at the Falls/Northern intersection as seen in alternative 1. The analysis further shows that the additional delays generated by new eastbound signal control at the alternate merge point is offset through improved signal-controlled lane changes and better

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queuing management. Eastbound travel time results are similar to that of no build conditions during the morning peak with travel time reductions of nearly 1.5 minutes in the evening peak hour.

The analysis shows that the additional delays generated by new eastbound signal control at the alternate merge point were offset through improved signal-controlled lane changes and better queuing management (**Table 6, Figure 23 through Figure 30**). Eastbound travel time results are similar to that of no build conditions during the morning peak with travel time reductions of nearly 1.5 minutes in the evening peak hour.

No queuing spillbacks are anticipated onto the JFX because the additional northbound ramp lane provides additional storage for vehicles at the traffic signal.

Table 6. Intersection Level of Service and Delay

INTERSECTION LEVEL OF SERVICE AND DELAY SUMMARY TABLE – AM (PM)										
Intersection	Approach	2030 No-Build			Alt 1 (Channelization)			Alt 22 (Alternative Merge)		
		Delay (sec/veh)	LOS	Max Queue (ft)	Delay (sec/veh)	LOS	Max Queue (ft)	Delay (sec/veh)	LOS	Max Queue (ft)
Falls Road at Northern Parkway	Overall	122.8 (114.1)	F (F)	- (-)	58.7 (49.2)	E (D)	- (-)	53.1 (51.1)	D (D)	- (-)
	Eastbound	47.5 (51.7)	D (D)	900 (1025)	91.1 (35.4)	F (D)	900 (900)	46.9 (42.0)	D (D)	675 (725)
	Westbound	177.6 (160.4)	F (F)	1950 (1500)	44.0 (64.3)	D (E)	550 (900)	57.4 (63.2)	E (E)	925 (900)
	Southbound	196.9 (224.2)	F (F)	1475 (1450)	39.6 (47.4)	D (D)	800 (500)	46.4 (45.0)	D (D)	900 (450)
	Northbound	75.3 (70.4)	E (E)	600 (475)	56.7 (61.9)	E (E)	425 (425)	73.6 (61.4)	E (E)	600 (425)

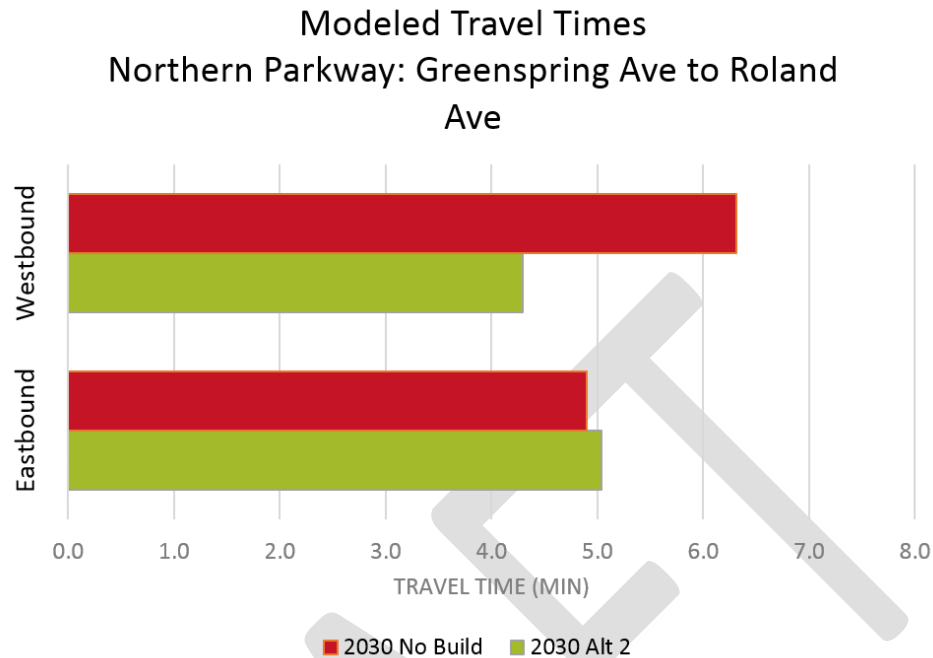


Figure 23. AM Modeled Travel Times

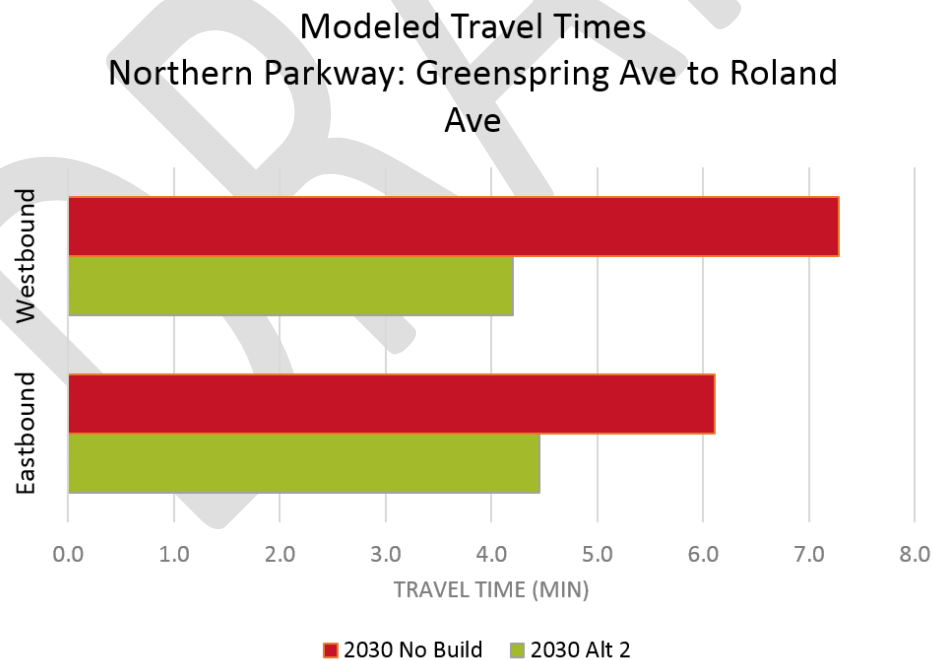


Figure 24. PM Modeled Travel Times

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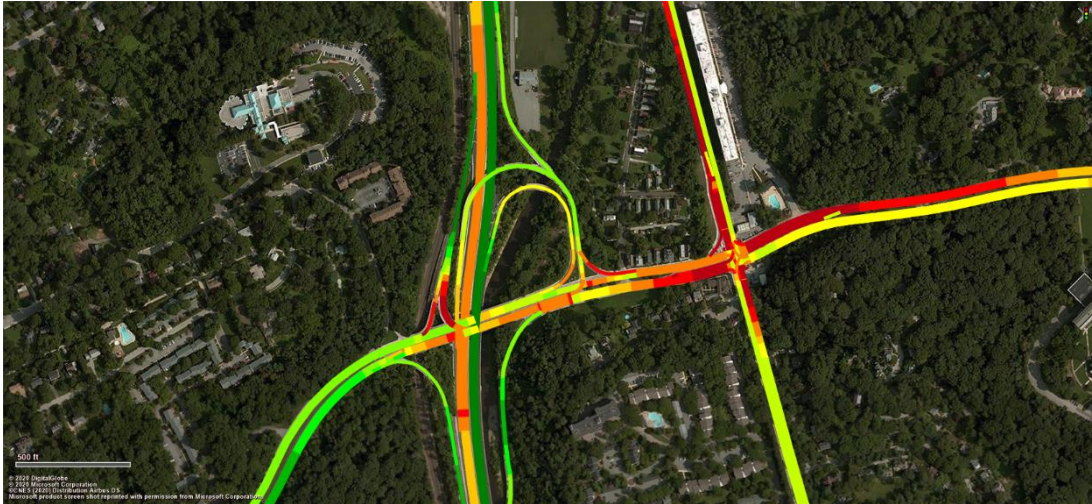


Figure 25. 2030 No-Build AM Peak

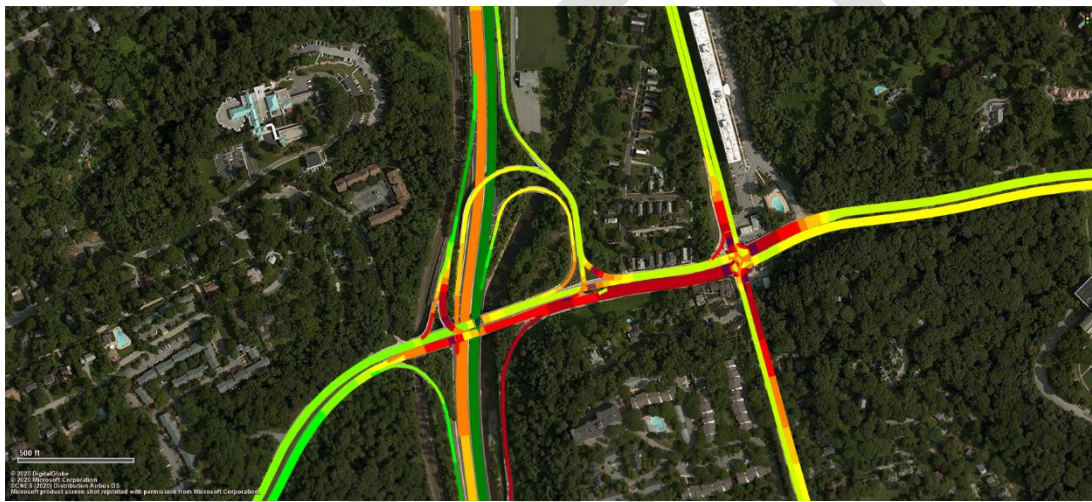


Figure 26. 2030 Alternate 1 AM Peak

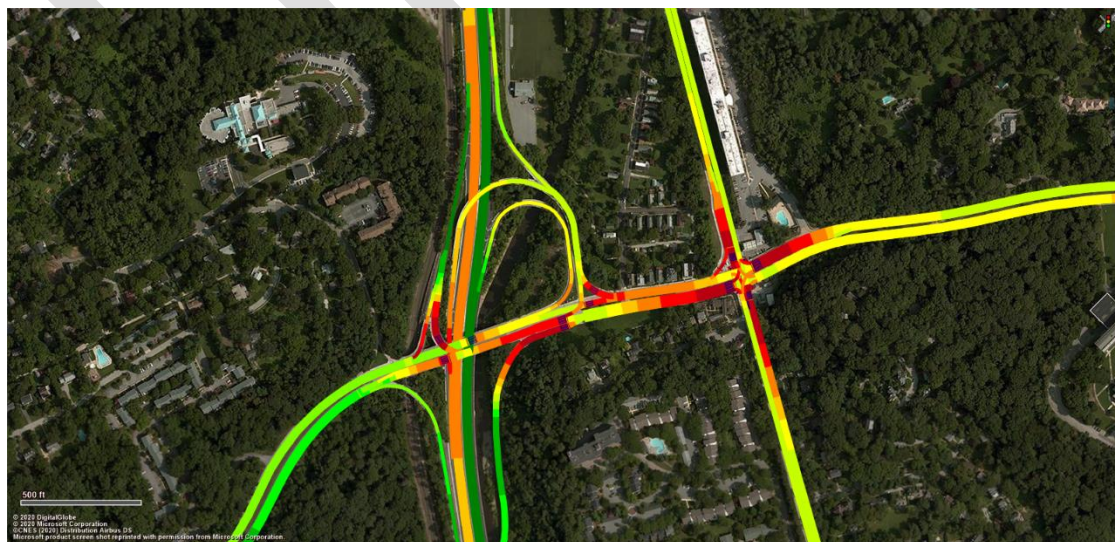


Figure 27. 2030 Alternate 2 AM Peak

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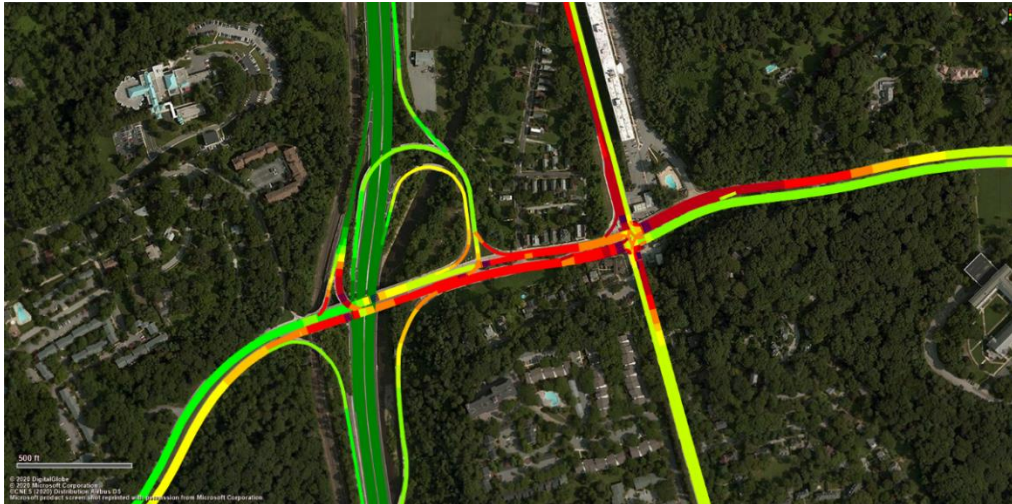


Figure 28. 2030 No-Build PM Peak



Figure 29. 2030 Alternate 1 PM Peak

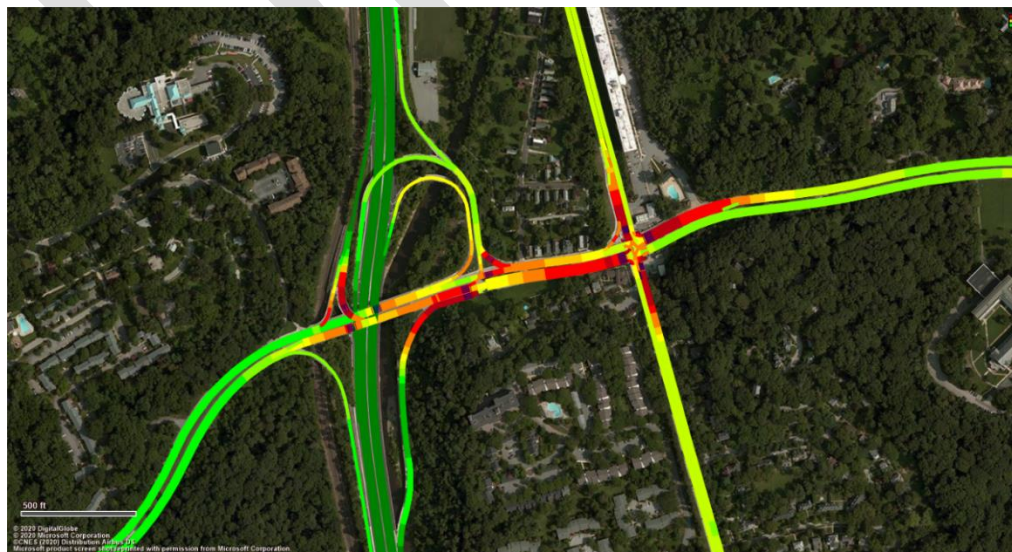


Figure 30. 2030 Alternate 2 PM Peak

Part 3. Recommended Program of Improvements

The analysis of existing conditions and consideration of alternatives indicates that a range of improvements are needed to achieve a state of good repair and provide better access and safety for bicyclists and pedestrians in the study area; and, to improve traffic operations and safety along Northern Parkway vicinity of Falls Road and the Jones Falls Expressway. Except for a few of the smaller maintenance-related items, it is strongly recommended that the improvements move together as a package because they are interrelated, and cost and time savings can be achieved by doing so. This will also make interagency coordination and review timelier as there will be less need to re-study each piece of the work to comply.

State of Good Repair¹³

As Part 1 indicates several deficiencies affect road user safety in the study area. While the Department of Transportation has many ongoing systemic and citywide programs to improve infrastructure, these items are most critical and should be included in the Falls Road/Northern Parkway project (**Figure 31**):

- **Replace interstate guide signs.** At a minimum, the guide sign on the westbound ramp to north and southbound I-83 must be replaced. The overhead structure's condition is unknown, but it may also need to be replaced.
- **Replace crash cushions and barriers.** Sand-filled crash cushions approaching the bridge structure and ramps have been damaged and no longer perform their intended function.
- **Replace safety fencing on Northern Parkway bridges over I-83.** Fencing on the south side of Northern Parkway is damaged and unstable (**Figure 31** Error! Reference source not found.); fencing on the north side has been improperly repaired at several locations.
- **Raise curb height.** This problem is particularly acute on both sides of Falls Road between Northern Parkway and Kelly Avenue and on the east side of Falls Road between Harvest Road and Northern Parkway. In those locations, ADA compliant ramps should also be installed where necessary.
- **Remove obstructions to sidewalk passage.** Hydrants, salt boxes, light poles, and sidewalk cracks pose obstacles to pedestrians throughout the study area in addition to the 56 missing curb ramps noted in the existing conditions documentation. In addition to making passage difficult or impossible for wheelchair users, these impediments can also compel pedestrians to walk in busy roadways for short distances, placing them at risk and inhibiting safe traffic flow.

The portion of the study area with the highest frequency of sidewalk obstructions is Falls Road southbound between Mattfeldt Avenue and Hillside Road. Just south of Mattfeldt Avenue, a steep slope and guardrail make rectifying these obstructions difficult. However, beginning approximately 400 feet north of Northern Parkway, the ground adjacent to the southbound sidewalk becomes level (except along the frontage of Green Fields Nursery), so passing zones could be constructed relatively easily. The following locations are recommended for obstruction removal:

- Falls Rd southbound just north of Northern Parkway: create sidewalk passing zones around 2 light poles
- Falls Rd southbound between Northern Parkway and Cross Keys Blvd: create sidewalk passing zones around 6 light poles and 2 fire hydrants

¹³ Detailed location drawings for all of the state of good repair improvements can be found in Appendix D.

Falls Road/Northern Parkway Corridors Study
Part 3. Recommended Program of Improvements

- Falls Road/Cross Keys Blvd intersection: create a sidewalk passing zone around the signal pole located on the southbound side intersection
- Falls Rd southbound between Cross Keys Blvd and Hillside Rd: create sidewalk passing zones around 10 light poles and 2 fire hydrants

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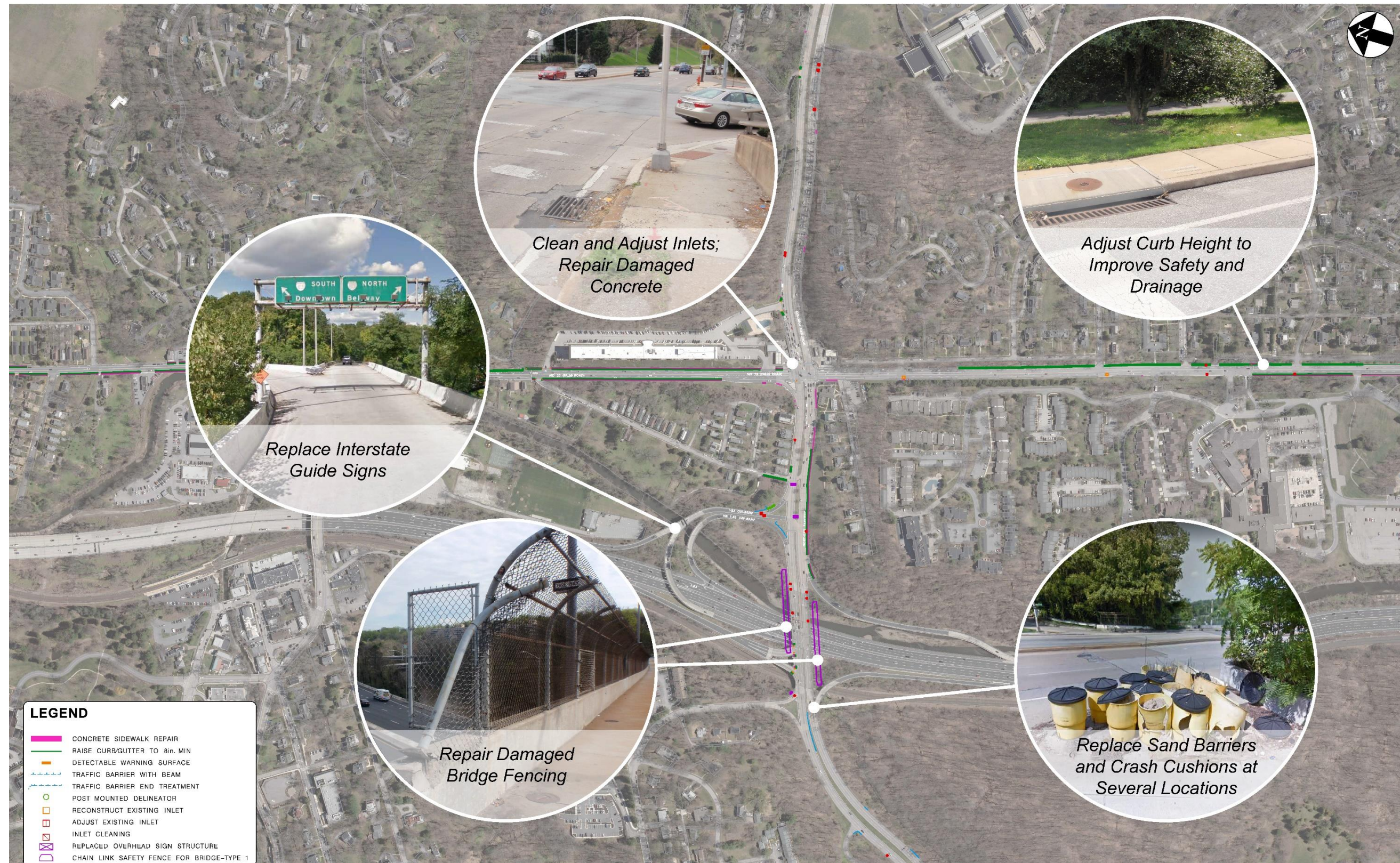


Figure 31. State of Good Repair Recommended Improvements

Transit

As the MTA bus network is undergoing further restructuring of the transit system (since Baltimore Link in 2018) due to significant revenue losses from the COVID-19, this report does not make any recommendations for new or enhanced transit service. Rather, the emphasis is on improving the bus stop infrastructure at key locations for the benefit of existing transit riders on bus routes which will remain in service. While nearly all bus stops in the study area could be upgraded with additional infrastructure, two in particular have strong needs that should be addressed in the short term: the eastbound stop along Northern Parkway at Falls Road and the northbound stop along Falls Road at Elmwood Road across from the entrance to Cross Keys.

Northern Parkway at Falls Road Bus Stop

The Northern Parkway eastbound bus stop at Falls Road is a transfer stop with approximately 100 boardings on a typical weekday. Most of these passengers' transfer from buses travelling northbound or southbound along Falls Road. MDOT MTA previously identified this stop as a candidate for a shelter but found that there was inadequate space for a shelter at the stop location due to steeply sloped terrain behind the sidewalk and thus too expensive and complex as a standalone project (Error! Reference source not found.). As part of a broader infrastructure project in the Falls Road/Northern Parkway area, it makes sense to include a new bus shelter, which will require minor excavation and a retaining wall (Figure 32).



Figure 32. Concept for New Shelter

Falls Road at Elmwood Road

Most transit passengers travelling to the Village at Cross Keys arrive from points south, alight at the Elmwood Road northbound stop, and then must cross Falls Road. While this is a signalized crossing, there is no curb ramp on the northbound side of the crossing and the 30-foot long, 4-foot, 6-inch wide landing area does not provide an adequate turnaround space for wheelchair users (**Figure 33**). In addition, the bench on the sidewalk segment prevents wheelchair users from accessing the pushbutton that activates the signalized pedestrian crossing, and there is a gap between the north end of the sidewalk and pushbutton that may exceed the distance able to be reached by some wheelchair users. These access obstructions could be rectified by adding a new curb ramp and installing a larger concrete pad. This project could be implemented as part of the City's annual curb/sidewalk program.



Figure 33. Existing Landing Area for Transit Users

In addition to these specific stop improvements, the City should continue to support and encourage MDOT MTA's systemwide performance and reliability improvements, which will benefit transit riders travelling through the study area and throughout the City.

Pedestrian and Bicycle Access and Safety

As indicated above, there are dozens of improvements that could be made to the bicycle and pedestrian network ranging from construction of ADA ramps and placement of bicycle ramps to entirely new trail components. This plan recommends two specific projects that would bring meaningful improvement and increase connectivity among non-auto transportation modes.

Road Diet – Falls Road

The Bicycle Master Plan designates Falls Road between Cold Spring Lane and Kelly Avenue as a future “Main Route” (a bike lane, buffered bike lane, or cycle track). Implementing this recommendation along Falls Road, which currently has a four-lane cross section with no shoulders, could be accomplished by widening Falls Road—which would have property, environmental, and historic district impacts—or by implementing a “road diet.” The road diet would convert Falls Road from a three-lane cross section from the existing pedestrian refuge median at Deer Ridge Drive northwards (**Figure 34**). The road diet could be achieved simply by restriping Falls Road or with curbed mean in certain area to protect turn lanes and provide a visual effect that slows traffic. A preliminary analysis of traffic volumes along the segment of Falls Road south of Northern Parkway indicates that this area is suitable for lane reduction.



Figure 34. Falls Road Between Hillside Road and Hamill Road (With Road Diet)

North of Northern Parkway, queues and delays southbound at the Northern Parkway intersection and northbound at the Kelly Avenue intersection mean that implementing a road diet is less straightforward. It may be possible to provide two southbound and one northbound lane between Falls Road and Mattfeldt Avenue, reallocating the remaining space to bike lanes. North of Mattfeldt, however, heavily used on-street parking north of Mattfeldt Avenue occupies the curb in the southbound direction, and the roadway has only one southbound lane. Therefore, there is no clear space available in the roadway for reallocation to bicycle use.

Jones Falls Trail Extension

Currently, the Jones Falls Trail extends from Downtown north to Mount Washington, with the northernmost segment (Phase V) linking Cylburn Arboretum with Kelly Avenue. Both Baltimore City and Baltimore County have identified an extension of this pathway towards Lake Roland as a critical linkage that would connect City residents with the recreational opportunities available in Lake Roland Park and County residents with employment, commercial, and cultural destinations in the City (**Figure 35**).



Figure 35. Existing Jones Falls Trail With Proposed Extension

A boardwalk completed in 2011 connects the Falls Road Light Rail station to Lake Roland, so a future trail segment would roughly parallel the light rail tracks between Mount Washington and Falls Road station,

diverging to the northwest around BGE's Mount Washington electrical substation. This trail would also connect northwest to Clarkview Road, in accordance with the Ruxton-Riderwood-Lake Roland Area's Bare Hills Village vision, providing access to the commercial destinations in Bare Hills and points north. Baltimore City and Baltimore County should seek a Maryland Bikeways planning grant from MDOT to further develop this concept.

Improving Crossing of I-83/Jones Falls for Bicyclists and Pedestrians

There are currently only four crossings of I-83 and the Jones Falls within the study area, none of which provides adequate accommodation for pedestrians and cyclists; sidewalks along Cold Spring Lane and Northern Parkway provide accessible passage for pedestrians but those roadways are inhospitable for bicycling, and Kelly



Figure 36. Mount Washington Station Underpass

Avenue also provides pedestrian access but can be traversed only by skilled and confident bicycle riders. The pedestrian underpass connecting the Mount Washington light rail station and Smith Avenue provides a safe and separated way for pedestrians to cross under I-83 (**Figure 36**), but stairs preclude its use by bicyclists and people with disabilities.

Upgrading one or more of these existing crossings would greatly enhance bicycle and pedestrian access in the east-west direction but require substantial construction or a reduction in travel lanes on Northern Parkway or Cold Spring Lane, all of which experience congestion. No action is recommended at this time.

Traffic and Roadways

As discussed in Part 1 (Existing Conditions), by far the most congested intersections in the study area are along Northern Parkway at Falls Road and approaching the JFX on- and off-ramps. As such, this section recommends moving forward with the westbound choice lane and eastbound alternating merge lane.

Additional access management, safety and neighborhood circulation improvements are also recommended for Mattfeldt Avenue. The recommended program of traffic and roadway improvements includes:

Westbound Choice Lane to I-83 Ramps

Vehicles travelling west along Northern Parkway must currently get into the right (northernmost) lane to use the I-83 exit ramp which splits for northbound and southbound travel. As a result of the heavy volumes, vehicles often queue well before Falls Road or attempt a late merge just after Falls Road to access the ramp. To create a westbound choice lane, the JFX on-ramp approaching from the from westbound Northern Parkway would be widened from its existing width of 20' (approx.) to a 30' width to allow for two lanes of traffic. The widened section would continue until tapering back to the existing width reaching the bridge structure. The existing guardrail on the north east side will have to be relocated due to the widening of the on ramp, and a portion of the north east pedestrian sidewalk crossing the on ramp he will need to be rebuilt. Trees along the east side will have to be removed due to the grading limits. It is

intended that no permanent right-of-way acquisition is necessary to consolidate the east side access points; however, temporary construction easements may be required.

Eastbound Alternating Merge

As discussed above, the I-83 off ramp approaching eastbound Northern Parkway would be widened from its existing width of 20' (approx.) to a 30' width to allow for two lanes of traffic. A retaining wall of up to 8' tall may be needed as the ramp ties into Northern Parkway in order to taper the road back into the mainline and reconstruct the sidewalk on Northern Parkway. A few trees along the east side of the off ramp may need removed due to the grading limits and to improve sight distance. Approximately six streetlights and three storm drains would to be relocated and three drainage structures reset. No impacts to private property are expected.

Mattfeldt Community Access and Parking

To minimize congestion and make for safer travel along westbound Northern Parkway, it is proposed that parking being restricted at all times. Additionally, Mattfeldt Avenue would be converted to right-in, right-out only. To maintain full access to the Mattfeldt community, a new traffic signal permitting all movements would be placed on Falls Road opposite a consolidated entrance to Cliffhurst Road and Belvedere Towers. Two 12' lanes would exit from the relocated Cliffhurst Road, and one 14' lane would enter Cliffhurst Road.

To construct the consolidated access on the east side of Falls Road, a retaining wall of approximately 13' is necessary and would most likely be built concurrent with construction of the new residential complex proposed adjacent to Belvedere Towers. It is intended that no permanent right-of-way acquisition is necessary to consolidate the east side access points; however, temporary construction easements may be required.

In addition, it is proposed that a parking pad be installed on City-owned property just west of Mattfeldt Avenue north Northern Parkway. Seven parking spaces are provided for which approximates the number of vehicles can presently park on Northern Parkway.

Falls Road Access Management

The uncontrolled movement of cars into and out of the Shell Station and Belvedere Towers on Falls Road just north of Northern Parkway creates unnecessary traffic congestion at the core intersection of this study. As such, it is proposed that access to the Shell Station and Belvedere Towers be converted to right-in, right-out and that all left turns be made from the new traffic signal described above.

Project Cost and Delivery

The estimated cost of the recommended improvement program is listed below as individual projects (**Table 7**); however, it is strongly recommended that the improvements move together as a package because they are interrelated. For example, the Falls Road intersection realignment is closely tied to the partial closure of the Mattfeldt Avenue. The parking pad for Mattfeldt Avenue residents is tied to the removal of on-street parking along Northern Parkway.

Table 7. ESTIMATE FOR RECOMMENDED IMPROVEMENTS (2020 DOLLARS)

ELEMENT	COST ESTIMATE
State of Good Repair Improvements	\$500,000 – \$700,000
JFX Ramp Improvements	\$3,100,000 – \$3,800,000
Mattfeldt/Cliffhurst/Belvedere Tower Intersection Realignment	<i>Developer-Funded</i>
Falls Road Access Management	\$50,000 - \$70,000
Transit Improvements	\$80,000 - \$100,000
Construction Cost (inc. 30% contingency)	\$4,849,000 - \$6,071,000
Design & Construction Inspection (15% of construction)	\$727,350 - \$910,650
Total	\$5,576,350 - \$6,981,650

Design and Regulatory Coordination Required

The following agencies or property owners should be coordinated with as the project moves forward:

- **MDOT SHA:** Advancing forward with the ramp improvements to and from the JFX will require coordination with and approval by the MDOT State Highway Administration (SHA). This coordination has been initiated as outlined in **Appendix F**.
- **MDOT MTA:** Improvements to bus stops should be coordinated with the MDOT Maryland Transit Administration (MTA).
- **Adjacent Development:** Advancing forward with the realignment and signalization of the intersection of Mattfeldt Avenue with Cliffhurst Road and Belvedere Tower should be closely coordinated with the developer of the proposed new apartment building on the Belvedere Tower property. The traffic signal at the realigned intersection more fully meets signal warrant requirements with the additional development and with implementation of access management improvements at the south entrance to Belvedere Tower.
- **Maryland Historical Trust:** The only improvements proposed within the adjacent Roland Park Historic District are the bus shelter at Falls Road and Northern Parkway and the landing pad for bus riders at Elmwood Road. Minimal coordination with MHT can be expected.
- **Wetlands, Waterways and Floodplain:** If the JFX ramp improvements are constructed within the limits as described, there are no wetlands or waterways within the jurisdiction of the US Army Corps of Engineers that would be impacted by the project. There may or may not be coordination required with the Maryland Department of the Environment as the project sits at the edge of the regulatory floodway.

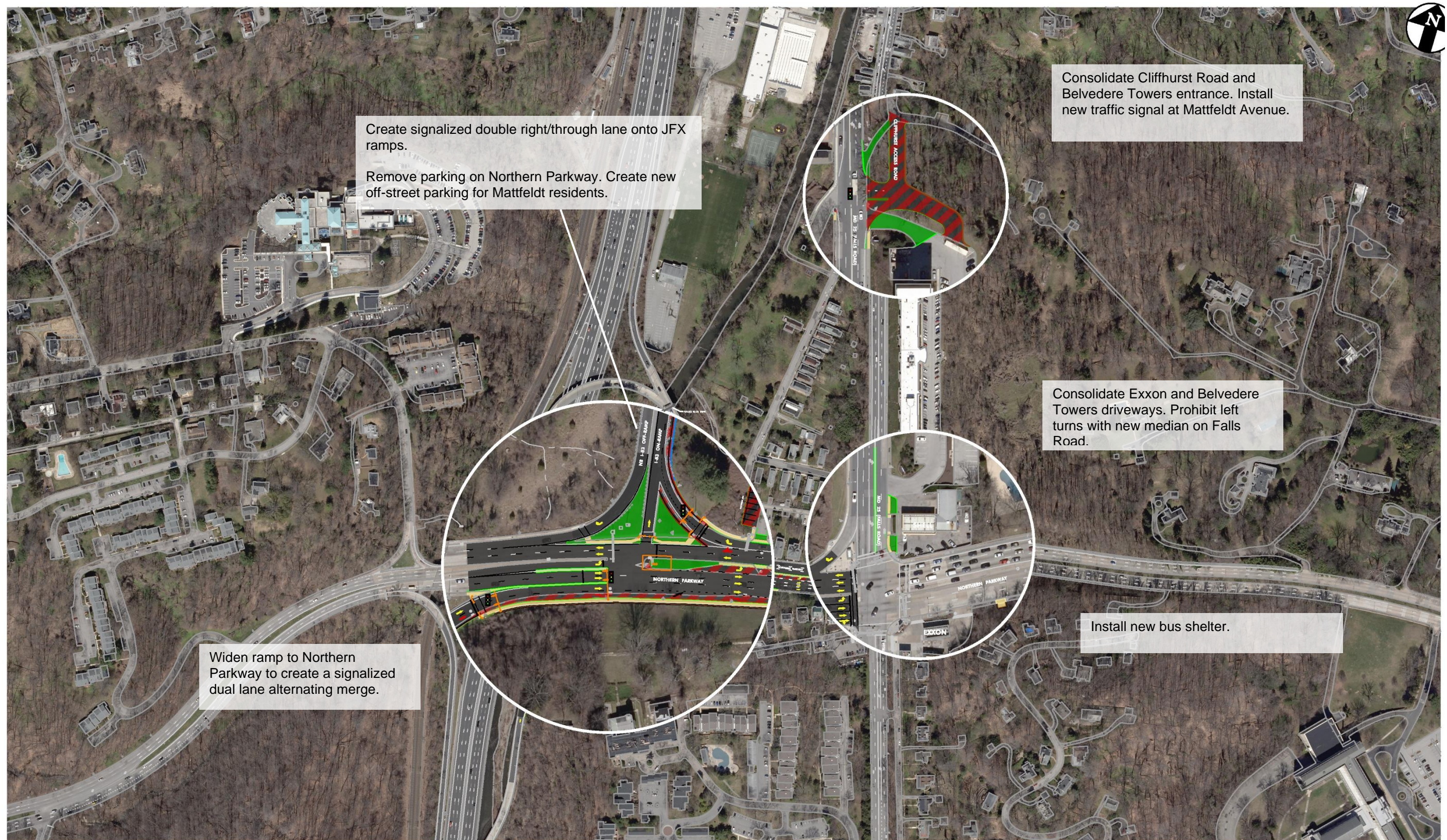


Figure 37. Concept Options

Appendix A. Prior Plans and Studies

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Appendix B. Existing Conditions

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Appendix C. Traffic Tech Report

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Appendix D. SOGR Plan Sheets

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Appendix E. Mattfeldt Avenue Signal Warrant

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Appendix F. IAPA Correspondence

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Appendix G. Public Meeting Documentation

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